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The Water-Supply of Towns.

CITY communities have almost invariably grown up in the vicinity of water, instinctively realising the necessity of this gift of nature. As, however, they have increased in proportions, the supplies of water, which were sufficient for them in their earlier days, have frequently become overtaxed, and larger supplies have had to be obtained. As the growth of communities is rarely rapid, it has generally been possible to further develop the original sources or to supplement them from the immediate locality. But there are other influences at work which impede this co-extension of a local water-supply with an increasing population, for the causes of pollution which are ever attendant upon modern civilisation, are increasing too, and sources (except such as are deep-seated) which are situated in or passing through populated areas have one by one to be abandoned. An era comes at length in the history of almost every community when the local sources of supply become inadequate, and the serious question has to be asked, "Where are we to get our water?" This difficult problem, which has become more important year by year, has been most worthily met by the engineering profession throughout the world, and "waterworks engineering" has arisen as a special branch of the profession. It is with great pleasure that we chronicle an addition to the literature of this important branch of engineering, and we congratulate the author upon the practical, straightforward common-sense shown in the preparation of this work.*

The early contributions to this class of writing were mostly from the pens of eminent scientists, and partook more of the academy than of the field. They treated only a narrow though important branch of the investigation, and the results they arrived at were mostly founded upon ingenious theoretical calculations and practice limited to the laboratory. The works which have followed are mostly infected with the strain of their predecessors, and are replete with abstruse mathematical refinements. There is a pre-Raphaelitism in science as in art, the real essence of great engineering truths being frequently clouded, and even totally obscured, by a mass of intricate details which are insignificant in their practical bearing. Approximation within certain limits has ever been the aim of great engineers, to whom we owe most of our simplest formulæ and rules.

The author introduces his subject with a few well-selected reasons for the construction of waterworks on a large scale, and dives slightly into the history of early systems.

With regard to the important question as to whether waterworks for public supply should be in the hands of private companies or should be municipal undertakings, the author is very decided. He says "that a matter of such vast importance to the public health is not one which should be left in private hands; and, indeed, that it is not a matter from which profit should be made at all—that is to say, a direct money profit for individuals, or even a municipality. The profit, of a most solid kind, to the community is undoubted." He points out, however, that supplies of water have been provided in certain places through the instrumentality of private companies which would not otherwise have been available. A reservation is made as to supplies for "manufacturing purposes or for purposes purely of luxury—such as gardens and fountains," these being considered as a fair field for profit. The author is also of opinion that insurance against loss by fire is another legitimate field for profit as regards water-supply. It is not very clear, however, how this can be placed upon a practical basis except by voluntary concessions upon the part of the insurance companies. The important bearing which an efficient water-supply has upon the value of property in America is shown by the following extracts from Mr. Fanning's "Water-Supply Engineering."

"At Columbus, Ohio, the average loss by fire for the four years preceding the completion of the public waterworks was $\frac{62}{100}$ of 1 per cent. of the valuation. The average loss during the first four years after the completion of the works was $\frac{12}{100}$, and during the fifth year, from April 1, 1875, to April 1, 1876, was $\frac{11}{100}$ of (1 per cent.) the valuation. These statistics show a probable saving in the first four years of upwards of one-half million dollars, and in five years of more than the entire cost of the waterworks."

Mr. Fanning further states that:—

"In a recently-adopted schedule of the National Board of Underwriters there are *additions* to a minimum *standard rate* in a standard city, which is provided with good water-supply, fire-alarm, &c., as follows, termed 'deficiency charges':—

Minimum standard rate of insurance of a standard building	25 cents.
If no water supply	15 ,,
If only cisterns, or equivalent	10 ,,
If system is other than gravity	05 ,,
If no fire department	25 ,,
If no public organisation	05 ,,
If no building law in force.....	05 ,,

The financial value of the enhanced fire risk, as deduced by the Board from an immense mass of statistics, and the additional premium charged on the most favourable buildings, is 60 per cent., without good waterworks, and 40 per cent. if only fire-cisterns are provided."

The value of chemical analysis in the selection of a source of water-supply is fully discussed, and the engineer is warned against being led blindfold by it. The author says:—"Should the report of the chemist be condemnatory, the water may be condemned out of hand, at any rate after a second analysis has confirmed the first; but, if the result of the analysis is to indicate a pure water, more care is necessary on the part of the engineer. He must make a personal examination of the source; if it is a river or a stream he should follow it to its beginning, noting along both banks what possible sources of pollution there may be. Whatever the result of a chemical examination may have been, the water of a river should be condemned if it is found that there is a copious discharge of sewage into it a mile or so above the proposed intake." The practice of forming an opinion upon a source of water-supply from a single analysis is severely condemned. This naturally leads to a consideration of the self-purification of natural streams. The dictum of the Rivers Pollution Commission, "that there is no river in the United Kingdom long enough to effect the destruction of sewage by oxidation," has, as a result of recent investigations, to bear considerable modification; and when it is remembered that the rivers of this country are almost microscopic as regards their length in comparison with many foreign rivers, it is

* "The Water-Supply of Towns." By W. K. Burton, A.M.Inst.C.E. London: Crosby Lockwood & Son.

probable that the latter may become polluted and self-purified several times during their course.

The common impurities met with in water are classified as :—

1. Dissolved inorganic matter.
2. Suspended inorganic matter.
3. Dissolved organic matter.
4. Suspended organic matter.
5. Micro-organisms.

These sub-divisions are separately described, and their influence upon the quality of the water indicated. The various sources of water-supply are classified, and ably described.

The next subject dealt with is the quantity of water to be provided. The author commences by strongly advocating the use of the cubic foot, instead of the gallon, as the unit of measurement for waterworks purposes. We entirely agree with him in this, both for the sake of accuracy and of simplicity. The confusion often caused by the difference in capacity between the imperial gallon of Great Britain and the United States gallon (five of the latter being equal to four of the former), is adduced as an important reason.

The supply of water per head per day, necessary for all purposes, exclusive of trade and manufacturing purposes, is estimated by Mr. Burton as follows :—

2 (or even (2½) cubic ft. (=12½ to 15⅝ gals.) of water per head per day, is an unusually small mean supply.

3 (or at the most 3½) cubic ft. (18¾ to 21⅞ gals.) mean supply per head per day ought to be sufficient in nearly all cases.

4 cubic ft. (=25 gals.) per head per day is stated as a very ample mean supply.

These figures presume that a fair amount of care is taken to prevent waste.

The author points out that in England and on the Continent very stringent regulations for the prevention of waste have in some cases reduced the mean consumption, even in water-closet towns, to the lowest figures given above. This may be very possible at many places on the Continent, no doubt, where ideas as to the use of baths and as to cleanliness generally are very much behind those which are fortunately now general in England; but it is perfectly certain that any town reduced to such a supply as 15 gallons per head per day is most inadequately supplied with water, and that any such standard for English cities at the present time is ridiculous; and in our opinion the author's maximum supply of 25 gallons is not by any means so ample a one as he seems to consider it.

The conditions of supply are considered under the following heads :—

1. Where the minimum supply equals, or is greater than, the quantity demanded.
2. Where the minimum supply is less than the quantity demanded, but the average supply is equal to, or greater than, the quantity demanded.
3. Where the average supply is less than the quantity demanded.

The first division indicates sources that are sufficient and require no storage; the second those that are insufficient without storage; and the third those that are insufficient. The usual methods for calculating the yield of a source by gauging over weirs and by observing the velocity of flow in channels with floats or instruments are referred to.

The next chapter deals with the storage capacity to be provided for impounding reservoirs, and the varying elements upon which the calculation must be based. A reservoir plays much the same part in connection with a waterworks that a fly-wheel does in regard to a steam-engine, allowing the supply to accumulate at such times as it may (within certain limits) exceed the demand, to be expended when the situation is reversed. In this calculation the author points out that the requisite storage must depend upon the proportion that the available quantity of water bears to the total rainfall over the catchment area (the difference between these quantities being due to evaporation, absorption, and transference to other catchment areas in the form of springs). As this coefficient varies with the extent and physical nature of the surface of the catchment area, formulæ which do not take these variations into account cannot be of general application. The author, however, states that Mr. Thomas Hawkesley's well-known formula $c = \frac{100}{\sqrt{r}}$ has "undoubtedly been found to apply with approximate accuracy to England."

In discussing the question of filtration, the author makes a strong point of regulating the speed of filtration through sand, and mentions an automatic system to effect this, designed by himself for the Tokio Waterworks. He considers that a perfect system of filter-bed discharge should be adjustable to any determined speed and remain constant at that speed; that the filter-bed should be capable of being filled from below; that the waste of water in cleaning out the beds should be reduced to a minimum; and that the apparatus should indicate when a certain maximum head for overcoming the friction of the filter-bed has been reached.

Very meagre information is afforded as to the use of polarite for water filtration. On p. 80 the author quotes a statement that polarite is pure magnetic oxide of iron. The following is an analysis by Sir Henry Roscoe :—

Magnetic oxide of iron	53·85 per cent.
Silica	25·50 ,, ,,
Lime	2·01 ,, ,,
Alumina	5·68 ,, ,,
Magnesia	7·55 ,, ,,
Carbonaceous matter and moisture	5·41 ,, ,,

With regard to the quotation as to the rate of filtration through polarite, 100 to 1,000 gallons per square yard in twenty-four hours (p. 117) we believe that at the Reading Corporation Waterworks 15,000 gallons of water per square yard of filter are purified in twenty-four hours.

A "service reservoir," as distinct from a storage reservoir, compensates for the diurnal variations in the demand for water, as well as providing a further supply of water for fire-extinguishing purposes. Any excess of capacity over that required for these purposes will, therefore, cause stagnation, thus deteriorating the quality of the water. The author says, quoting from Mr. Henry Gill, M.Inst.C.E., "Investigation has proved that if a service-reservoir has a capacity corresponding to seven hours' mean supply it is capable of compensating for the inequality of the consumption during the twenty-four hours, even at times of maximum daily consumption." This makes no allowance for fires, which, if they occurred when the reservoir was nearly empty, would necessitate the opening of the by-pass. The author considers this too low a standard, and suggests, tentatively, that a capacity of at least nine or ten hours' mean supply should be adopted, apart from an ample provision for fire. We would venture to say that even the author's standard is too modest.

The subjects of pumping-machinery and distributing systems are well treated, though one cannot but remark on the very slight reference as to the laws which govern the flow of water in pipes and channels; a subject generally so much more fully treated in works of this class. On the other hand, some very interesting details are given, in the chapter upon pipes, as to wrought-iron and steel rivetted pipes. As these pipes are made from rolled plates, uniformity in the thickness of the metal can be secured with much less weight. Taking this into consideration, as well as the greater tensile strength of steel, the author says :—

"The pipes (steel) may be made even less than one-half to one-quarter the weight of cast-iron pipes of the same diameter, to work at the same pressure. . . . Allowing a very ample factor of safety, allowing for some inequalities in the thickness of the plates from which the pipes are made, and also allowing amply for the reduction of strength by the rivet-holes, the weight of mild steel pipes will be found to vary from about one-third to one-seventh that of cast-iron pipes. The advantage in the matter of freight is, however, even in a higher ratio than this, as the pipes lend themselves more readily to 'nesting' than do cast-iron pipes. This is particularly true when, as is often done, the pipes are shipped unrivetted. . . . Breakage . . . may be said not to occur at all in the case of wrought-iron or mild steel pipes."

The importance of these advantages, where pipes have to be conveyed long distances either by sea or over-land, will be readily apparent.

The use of wooden pipes is stigmatised by the author as a "backward step"; but this is only true in a qualified sense. Where water has to be carried long distances, the pressure at no point being great; where the carriage of heavy materials is difficult and expensive; and where suitable wood is plentiful and at hand, the practice is economical and satisfactory. It has been found so after fair trial in the United States, and an interesting description of the method of construction employed is to be found in a communication from Mr. J. D. Schuyler, the American engineer, printed in the "Proceedings of the Institution of Civil Engineers," Vol. CXVII.

Appended to this work is a short essay by Professor John Milne, F.R.S., upon "The Effects of Earthquakes on Waterworks." His advice may be summarised as follows: In erecting buildings or laying lines of pipes, avoid soft or steep ground and river-banks. Leave an open area around the basement of a building. Avoid arch-work. Make the bases of all structures rising above the ground of increased strength. Use only good materials, particularly good cement.

A second appendix consists of a collection of notes, some of which are from the pen of Dr. E. Divers, F.R.S. Dr. Divers' criticisms are, to say the least, amusing, if somewhat dictatorial. The book is profusely illustrated both by means of plates and diagrams. These have evidently been prepared with great care, and cannot fail to be of great assistance to the student.

HAMPSTEAD CENTRAL PUBLIC FREE LIBRARY.

FOUR sets of designs submitted in a limited competition for the above have been on view this week at the Hampstead Vestry Hall, the competing architects being Messrs. Basil Champneys, Horace Field, T. G. Jackson, A.R.A., and Arnold S. Tayler.

The decision of the Library Commissioners had at the time of our visit not yet been made, but there can be little doubt as to the relative merit of the designs. That by Mr. Horace Field is clearly superior to all the others, and is most nearly approached by that of Mr. Basil Champneys, the remaining two designs being by a long way inferior to those already mentioned.

The site is at the corner of Arkwright-road and Finchley-road, and has a steep fall along the Arkwright-road frontage towards the Finchley-road. All of the competitors have placed the entrance to the library on the Arkwright-road frontage, and the lecture-hall proposed as part of the scheme at the opposite end of the site to the Finchley-road; thus advantage is taken of the fall of the ground to get a well-lighted basement under the level of the library floor.

Mr. Horace Field's plan is simple, straightforward, and admits of easy supervision and economical working, whilst the rooms are well lighted and the details well worked out. Entering from Arkwright-road, with the necessary steps placed externally, access is obtained by a shallow porch to an ample entrance-hall. Immediately in front is the lending library; on the right, the reference library; and on the left, facing Finchley-road, the news-room and magazine-room.

The librarian's room is in a quiet position at the rear of the reference library, which it overlooks. The lecture-hall is well propor-

tioned, readily accessible from the library building, and has adequate means of exit. The book-stores and repairing department are in the basement, and a contemplated future extension is suggested over the magazine and news room. The exterior is treated in a dignified and picturesque version of Georgian work, according well with the local spirit of old Hampstead. No undue extravagance raises the cost beyond the limits of the financial conditions of free public libraries.

The plan submitted by Mr. Basil Champneys is, as regards the library portion of the scheme, very similar in general lines to Mr. Field's design, though the details are not so fully or so adequately worked out. The lecture-hall is not so well managed, the cloak-room accommodation is inadequate, and the entrance unskilfully arranged. The lecture-hall does not communicate with the library except by a suggested door into the reference-library. The exterior is picturesque and simple in treatment, quiet and refined, and the design is possibly one of the least costly of those submitted.

Mr. Arnold S. Tayler has not carefully studied the requirements of modern free libraries, and, lacking experience, has evolved his plan from his inner consciousness. The plan is therefore marked by a rabbit-warren character, lacks efficiency of supervision, and would be costly in administration. The proportions of the lecture-hall are very unsatisfactory, and we fear the unfortunate lecturer would be practically inaudible to the majority of his listeners. The exterior is treated in the emasculated version of Tudor which some time ago was in vogue for educational establishments, and lacks interest. The drawings are carefully prepared, but the lack of experience has rendered abortive the considerable pains which the author has taken.

We regret very much to see the set of drawings to which the name of "Thos. G. Jackson" is appended. It would have been far more dignified for an architect in Mr. Jackson's position to have declined the invitation to compete rather than to have sent in a set of drawings which are a discredit to his reputation, and a reflection upon the fame of the Royal Academy, of which he is a member, and upon the Art of architecture of which he poses as an exponent. Mr. Jackson should remember that his position demands that he should uphold the dignity of architecture as an Art in the eyes of the world, both on its artistic and constructive side. The plan which Mr. Jackson submits shows either an absolute ignorance or a cynical disregard of all the requirements of a Free Public Library. A central elliptical hall has eight doors radiating to the various rooms, which are labelled with the names of their supposed uses, but there is no attempt at providing for the necessary supervision or the convenient working of the several departments, and it will be scarcely believed that the windows lighting the magazine and newspaper rooms on their longest sides look on to an area 11 ft. wide, on the opposite side of which is the lecture-hall, 24 ft. high to the eaves, and 46 ft. high to the ridge. The exterior is treated in a picturesque but extravagantly-expensive manner, whilst the design is characterised by an unsatisfactory lack of good proportion, and the insertion of coarse and eccentric detail. In fact, taking it all round, the design is quite unworthy of its author.

NOTES.

IT is unfortunate that the question of the ventilation of hospitals, which is such a very serious and difficult one, should appear too often to be considered from a polemical rather than a purely scientific point of view. Comparing the general tenour of Mr. Young's paper at the Architectural Association with the speeches which followed it, one cannot but think that the real object was to make a demonstration against any "new-fangled" systems of artificial ventilation, and that the medical men and Mr. Young's friend Mr. Graham were specially invited to uphold this view. We are not committed to one view or the other—natural or mechanical, as we think more experience is required before the question can be considered settled; but we should like to have heard a little more of both sides. The only circumstances under which we consider that mechanical ventilation is an absolute *sine quâ non* are those which exist in buildings, such as public rooms, meeting-rooms of all kinds, which at special and limited times are often crowded in an exceptional manner. Any one who doubts the need for mechanical ventilation in such cases we should set down as either ignorant or perverse. It may be that, as Mr. Young's paper would imply, a hospital should be regarded merely as a large house full of sick people, and treated as such; but there are certain considerations on the other side of which no hint was given in the paper. A hospital in a crowded city, for instance, is in a perfectly different case from a hospital on a country site; the air is full of impurities, and it is a most important question whether it should not be a paramount object to employ a system of ventilation under which the point of admission of air can be selected, and the air cleansed before its diffusion in the building. There are disadvantages in connexion with such a system, but it has yet to be seen whether its advantages do not outweigh them, at all events for winter. No one believes more in open windows than we do, and we have always declined to countenance any system of artificial ventilation which presupposes the permanent closing of windows; but the extent to which open-window ventilation can be trusted to in winter for sick people was much exaggerated in the discussion; nor must too much weight be attached to medical opinion on such a point. As a general rule medical men know very little about ventilation; they have each their own "fads" about it, and oppose the "fads" of all the others. Mr. Graham's light-hearted statement in the discussion, that "it mattered very little where inlets were placed," is not calculated to raise public confidence: there must be a better and worse way, and the public will expect architects to know which is which; nor is it any more satisfactory to be told that by open windows and fireplaces "we get a ventilating power at work both winter and summer." The circumstances are entirely different in winter and summer, and what answers at the one season does not necessarily answer in the other. Mr. Henman's system, which is to be employed at the Birmingham Hospital, has still to be tested, but it certainly deserves every attention, and under the circumstances Mr. Henman's remarks in the discussion may be said to have been very guarded and moderate. We do not think the discussion at the Association has advanced the subject much.

AMONGST the private Bills to be introduced next Session is one for a widening of the Strand on its south side between the west side of Ivy Bridge-lane and the east side of Carting- (formerly called Dirty-) lane, a widening of Carting-lane along its east side as far as Herbert's-passage, and alterations of the levels between the Strand and the Embankment-gardens. The Bill proposes to stop up what is yet left of Salisbury- and Cecil-streets; and to confer powers for the new undertaking upon the Liberator Permanent Benefit Building Society, and J. W. Hobbs & Co., Limited, and Mr. Samuel Wheeler or other the liquidator of those companies, or a company to be incorporated in that behalf. Ivy Bridge-lane, between Salisbury- and Adam-streets, marks the position of Ivy Bridge, *olim* Ulle-brig, in the Strand (cited by Stow as "now taken down"), and separates the City of Westminster from the Duchy of Lancaster liberty. On the site of the houses it is proposed to remove stood Salisbury House, built next west of the Bishop of Carlisle's "inn" (since Bedford, and then Worcester, House) by Sir Robert Cecil, afterwards Earl of Salisbury. Queen Elizabeth went to the house-warming on Dec. 6, 1602. William, the second earl, divided the house into two, taking Great Salisbury House for himself, and letting Little Salisbury House to his son-in-law, the Earl of Devonshire. Great Salisbury House and the Middle Exchange were pulled down, in 1695, for Cecil-street, at whose east side is Carting-lane. The site of Little Salisbury House was leased in 1692, for the building of Salisbury-street, which Payne rebuilt, and to which the brothers Adam added the concave circus and steps at the river end. The west portion of the circus stood over Ivy Bridge-lane, which was overlooked by the back bay-windows of one side of Salisbury-street. At the foot of the lane was the "Fox-under-the-Hill" tavern, by which—as our older readers may remember—was gained Salisbury-stairs* whence the halfpenny boats plied to London Bridge. After the explosion of the boilers of the *Cricket*, which killed six persons and injured many more, the steamboat traffic was discontinued, and the lane was closed by an iron gate at its Strand end. But for many years afterwards it could be ascended from the water-side, presenting a singular appearance, being covered for the greater part by portions of houses along each side which darkened the way and converted it into a tunnel square on section. Pennant records that the Earls of Rutland had a house near Ivy Bridge; at the site of one of the houses marked for demolition lived for nearly a century the Vaillants, foreign booksellers. Of the buildings that have been recently erected at the south ends of Cecil- and Salisbury-streets, between Carting- and Ivy Bridge-lanes, we gave accounts, with plans, section, and illustrations, on April 28 and October 20, 1888, and February 21, 1891.

THE report on an outbreak of diphtheria at Hythe, in the New Forest Rural Sanitary District, sent in by Dr. Bulstrode to the Local Government Board, states that the water supply of Hythe is derived for the most part from shallow wells situated in the curtilages of the cottages, and apparently sunk through the clay into an underlying water-bearing stratum. There is one public well fitted with a pump, but Dr. Bulstrode was unable to ascertain either its depth or the nature of its steining. The shallow wells are only dry-steined and not properly protected from the influx of surface impurities, and some are in dangerous proximity to privies. As to drainage, what is called the "sewer" is the result, it appears, of the gradual covering-in at different times of a streamlet which runs through part of the village, and empties itself into Southampton Water near the pier. The stream is said to be quite dried up during the warmer months of summer. Into this "sewer" several tributary sewers or drains enter, some of them apparently old brick culverts or drain-pipes, and others (the more recent additions) 6 in. and 9 in. glazed cement socketted pipes. Along what is known as South-street, there runs a 6-in. agricultural drain which discharges on to the foreshore. Houses that are "unconnected" with the "sewers" are drained direct to the foreshore, or into cesspools, from some of which overflow-pipes are said to pass into the "sewers." There are but few indoor sinks; usually the yard-gully is made to serve as a sink. Excrement is disposed of in the majority of instances by means of pit-privies, sunk below the ground-level, which are emptied

* See "Ivy Bridge" and "Salisbury Stairs" in S. & N. Buck's large riverside view: 1749.

by the occupiers when full. In some cases these privies are so near to houses as to render the pollution of the soil underlying the dwelling a by no means unlikely event. The principal predisposing causes of disease usually found in such cases—shortness of water, defective drainage, or none, and privies near dwellings, seldom emptied—are all found together at Hythe. Dr. Bulstrode was informed by one of the Guardians that a satisfactory water supply could be obtained for Hythe at a moderate outlay. Surely it is, then, the duty of the authorities to set about obtaining it without delay.

IN Dr. Horne's Report to the Local Government Board on the Prevalence of Scarlatina in the Hucknall Torkard Urban Sanitary District, we find that in this case the water supply is satisfactory. The water is obtained from the new red-sandstone formation in the parish of Calverton, and is pumped into a storage reservoir, and piped thence to taps in the houses or to stand-pipes. The supply, which is constant, is in the hands of the Sanitary Authority. There is also a system of sewers constructed of glazed earthenware pipes, though not in the best condition. When we come to excrement and refuse disposal, we find the usual conditions in rural districts. The ashpit-privy obtains almost exclusively throughout the district. The ashpits are capacious, with their floors usually sunk below the ground level; and they are not watertight; several were observed in bad repair, with their brickwork crumbling away; many also required emptying. It is to be noted, however, that in this case the Sanitary Authority contracts for the scavenging of the privies, the work being conducted between 10 p.m. and 9 a.m. in summer, and between 10 p.m. and 10 a.m. in winter. Nuisance, however, arises from throwing the privy contents in process of removal on to the ground near dwellings, which is intensified from the circumstance that, in many instances, the ground is either not at all or only partially paved. Probably, however, if the clearance were left to the inhabitants to carry out, the state of things would be much worse.

THE Trades Technical Schools carried on by the Carpenters' Company and other City Guilds have recently transferred their headquarters to the building at 155, Great Titchfield-street, for some time occupied by the Polytechnic, and at the invitation of the Carpenters' Company a large number of gentlemen interested in technical education attended to assist Sir Henry Roscoe in an inspection of the schools on Thursday last week. The building is well-adapted for a school of this sort, though its neighbourhood is somewhat obscure. The range of work is extensive, embracing woodcarving, carpentry and joinery, bricklaying and brick-cutting, painter-stainers' work, wheelwrights' work, and masonry and plasterers' work. Classes dealing with all these branches were at work, under competent instructors, at the time of the inspection, and we were impressed with the intelligent interest displayed by the students, most of whom seem to be of the artisan class. These students seem to be imbued with a desire to improve their workmanship and extend their range of experience, and the schools offer many excellent facilities for so doing. The lines of employment are too often exceedingly narrowing in their effect, and this disadvantage can be effectually counteracted by artisans attending these schools, where, in addition to the instruction given, considerable influence is brought to bear on the student by the models and photographs and other demonstrations of the most excellent past and present examples of the work of the different trades. We were much interested to notice the presence of the drawing-board and T-square in most of the workshops. Endeavours are evidently made to induce the student to master the intricacies of the setting and drawing out of the object which he is about to develop in the different materials. This institution is, without doubt, doing good work, and deserves all the success which has rendered necessary its recent move to larger premises.

IT is somewhat remarkable to find a monograph written for his doctor's degree by a German Professor beginning with a quotation from Sir Joshua Reynolds. Such is the case, however, with the discourse on "Greek Portrait Art" (Griechische Porträtkünst), just published by Dr. Franz Winter—a dissertation which should interest not only archæologists but all students of the history of art, and especially those who are interested in its more modern developments. Thirteen years ago we were all accustomed to think that "realism" in Greek portraiture was its latest development. Since the Acropolis excavations have yielded us a mass of portrait statues we have realised that the days of Peisistratos were a time of vivid realism and almost excessive individuality, out of which the "idealism," the *typical* manner of Pheidias and the *canonical* tendencies of Polycleitus, slowly developed. Then came a reaction towards realism, though with some attempt at the indication of character in a subjective manner. But here at first the new movement tended to the observation of accidentals—passing intense expressions, it needed an Apelles or Lysippos to understand and express the permanent man. It may be new to some to learn that ancient portrait art suffered badly from the nearest ancient approach to photography. The brother of Lysippos discovered the art of taking casts in plaster from the human face, the perfect accidental outside verisimilitude, pleasing, no doubt, to the untrained eye of friend and relative, but without any of the more subtle quality of expression, born of the true artist's comprehension.

A STAINED glass window has been on view this week at Messrs. Britten & Gilson's works, which is of considerable interest both for its originality of design and as an experiment with a new form of glass, the make of which is, we are informed, the suggestion of Mr. E. S. Prior, the architect. The glass is made by being blown into a mould with a roughened interior surface, and comes out as a glass smooth but wavy in surface on the blown side, and roughened on the mould side. The result is a thick pot-metal glass which gives a great richness and irridescence to the colour, and, in fact, approaches more to the consistency of some of the richest Mediæval glass than anything else we have seen. It is costly, but the effect is worth the cost. The window in question, designed by Miss Lowndes, is a three-light one with figures of St. Michael, St. Raphael, and St. Gabriel, and is an admirable specimen of genuine stained-glass design, entirely in pot-metal with the exception of a little surface-painting in the faces and the folds of the drapery. The leading of the light glass around the margin of the figures is treated specially, so as to carry out the effect of radiation intended to be conveyed in the design. The whole is emphatically a stained-glass design in the true sense, without the slightest taint of pictorial treatment.

THE "Christmas Numbers" of illustrated papers rarely contain anything which is worth speaking of from the artistic point of view; but we may congratulate the *Queen* on having issued, in its chromo-lithograph entitled "A Portrait Study," a coloured print which is in a better and purer style than the general run of such things. The other "chromo," "A Reverie," is also a very pretty composition. Why is not the artist's name given on the plate? It is a pity to find, in the body of the paper, the usual ugly and inartistic fashion-plates of women with waists of impossible and hideous tenuity. Why it should be supposed to be necessary, in illustrating a costume, to draw a figure such as cannot possibly exist in nature, is a mystery. One would have thought it was the very worst way to recommend a costume; it is certainly the worst possible example to set up in a lady's paper, whether in regard to art or healthfulness.

LETTER FROM PARIS.

SINCE our last letter, the question of the Metropolitan Railway has not made much progress, which seems to indicate that the Municipal Council, in spite of an apparent complaisance, is persisting in the blind hostility which for twenty years it has shown towards all the projects submitted to it. According to the latest information, the Council wished to demand from the Government, as an absolute condition, the engagement to construct a supplementary line from the east to the west, on the line of the Rue Reaumur. Government, on its side, has been exceedingly conciliatory, and inclined to make all kinds of concessions. It promises that if the Council accepts the immediate execution of the main lines, A and B, the line by Rue Reaumur shall be carried out in 1901. From 1901 to 1905 the connexion between the Gare de Lyon and the Gare St. Lazare, by way of the Place de la République, would be carried out; the remainder of the system would subsequently be carried out, and the City of Paris is to have the right to purchase the whole metropolitan railway system, as thus completed. That is how matters now stand. The city authorities continue to receive very coldly the Ministerial advances; the time passes, the public waits, and the all-powerful "Compagnie Général des Omnibus" has the satisfaction of seeing the inaction of the ministration prolonging, for its profit, the monopoly of an absurd transport system.

Paris has two new monuments: that to Duban, inaugurated a week since at the École des Beaux-Arts; and that erected at Père-la-Chaise in honour of the celebrated metal-founder, Barbedienne. M. Guillaume, the Director of the Académie de France at Rome, described in an eloquent speech the long and honourable career of Duban; gaining the Prix de Rome when still young; then, on his return from Italy, commissioned to carry out the École des Beaux-Arts; subsequently carrying out the restoration of the Sainte Chapelle, and of the Château of Blois, with a profound knowledge both of Renaissance and Mediæval architecture, "bringing the spirit of ancient art into his work under the Empire, as if the spirit of his illustrious predecessors, from the time of Pierre de Montereau, had passed into him." But these great works did not absorb him entirely, and Duban still found time to lend to the Municipality his experience and knowledge at the sittings of the architectural committees, as well as at the Municipal Council, which at that time included among its members another great artist, Eugène Delacroix. The events of the "année terrible" mortally affected the venerable architect, who died in 1870, overcome by the spectacle of the disasters of his country.

The Barbedienne monument does great honour to its sculptor, M. Alfred Boucher. It is certainly one of the best in Père-la-Chaise. On a high stele in Vosges stone is placed the bust of the eminent founder who has brought to perfection the casting of works of art. This pedestal, with a funeral urn in front of it, is accompanied by two female figures bearing palms; one, who symbolises Art, wears a helmet surmounted by a chimæra; the other, representing Industry, is armed with a hammer. At the foot of the sarcophagus forming the base of the monument is seated the figure of a young girl, letting fall a torch the flame of which is just extinguished.

The mention of these two monuments reminds us of the new monument to Balzac about which Paris has been much occupied the last few days. It may be remembered that it was the "Société des Gens de Lettres" which took the initiative in regard to this monument, which was to have been executed by Chapu. After the death of that artist, many other names were discussed, and finally, thanks to M. Zola, M. Auguste Rodin was chosen in preference to M. Marquet de Vasselot, author of an absurd statue of Lamartine which has been erected at Passy. The selection of M. Rodin was unanimously approved. It was even said that there was a sort of affinity between his temperament and that of the cele-

brated author of the "Comédie Humaine." Unfortunately M. Rodin, who was to have finished his work in eighteen months, is extremely conscientious and difficult to please, never content with his sketches, recommencing his studies again and again. He was, therefore, not ready at the time, and when once the allotted period was passed the "Société des Gens de Lettres," less patient than the State or the Municipality, complained bitterly about having advanced the artist a sum scarcely sufficient to pay for his first studies, and even threatened him with legal proceedings. M. Rodin, much hurt at this treatment, at once offered to return the money, only asking that he should have the necessary time to realise his conception of Balzac, which he had been studying incessantly for two years. The Société appeared disposed to accept this arrangement, but the partisans of M. de Vasselot are in hopes that M. Rodin will abandon the commission in disgust, and that in that case M. Zola will resign his post as President of the Committee. The matter is still under discussion, but public opinion is severe on the Société des Gens de Lettres, and astonishment is expressed that a society of novelists and poets—people who are generally susceptible in regard to their own works—should behave in this way to an artist so well known and so esteemed as M. Rodin.*

It is announced that M. Guadet, Vice-President of the Société Centrale, has been appointed by the Government Professor of the Theory of Architecture at the École Nationale des Beaux-Arts, in place of the late M. Edmond Guillaume. This is an excellent choice, since M. Guadet has been for eighteen years the respected head of one of the ateliers of the school. He is therefore fully prepared for the task of expounding publicly the theories which he has so long taught to his pupils, many of whom have become well-known artists. At the École des Beaux-Arts will shortly take place the exhibition of the casts from the monuments discovered by M. Homolle and the members of the French School at Athens, on the site formerly occupied by the ancient city of Delphi. Among these casts is a splendid figure of Antinoüs, perfect in all except the arms, an archaic Apollo in a good state of preservation, and other interesting fragments of Greek art.

The competition in perspective has just been decided at the École des Beaux-Arts. Medals have been awarded to M. Quilliet, pupil of M. Laloux; M. Neukomm and M. Charlet, pupils of M. Guadet; M. Tallant, pupil of M. Deglane; M. Guiard, pupil of M. Redon, and M. Prost, pupil of M. Marcel Lambert.

The sale of the pictures and drawings of the painter Charles Jacques has been the great artistic event of the month. The general results of this sale, which had been preceded by an exhibition in the Georges Petit Gallery, were given in the *Builder* last week. The manager of the gallery had got up for the occasion a splendid catalogue with a number of illustrations, and prefaced by a biography written by M. Jules Claretie. This exhibition, which comprised more than six-hundred objects, including some furniture executed by the artist himself, was exceedingly interesting, in spite of a certain monotony arising from the repetition of the same subjects. The purity of drawing and harmony of design, in the artist's ideal compositions, poetic in spite of their extreme simplicity, was not more remarkable than the extraordinary knowledge of animals displayed in his farm-yard scenes.

The Louvre is undergoing some important rearrangementa. The pictures of the German school, which were formerly in the Great Gallery, have been placed in a special gallery, hitherto occupied by the works of Joseph Vernet, which, in their turn, have been removed to the Musée de Marine. Thus the collection of German pictures, not a large one it is true, but with a certain value, will form a respectable group by the side of the fine collection of German drawings which have been recently hung. These various changes have been very well carried out under the direction of the new architect to the Louvre, M. Blondel, who is also giving his full attention to the dangers which may arise to our national collection from the dampness of the walls in the older portions of the Louvre—dangers of which the results are especially visible in various pictures of the Spanish and Italian schools. Among the recent gifts made to the Louvre may be noted four painted panels by Boucher, which formerly decorated the rooms of the Ministry of Finance, and which represent the "Repos des Bergères," "Le Vendange," "La Toilette," and "Diane au Bain."

We may mention also that the Cluny Museum has acquired, at the price of 21,000 frs., an ivory plaque in the form of a diptych, which dates from the fifth century, and was the principal object in the celebrated collection of Henri Baudot. In the centre of this plaque is the figure of a consul, believed to represent Stilicon, the nephew of the Emperor Theodore, while at his feet, in a kind of primitive perspective, is represented an amphitheatre of spectators looking on at combats between men and animals; representing perhaps the games that the consuls gave at the time of their investiture.

The Société Nationale des Beaux-Arts has decided to have a medal struck with the portraits of its two Presidents. M. Alexandre Charpentier, the sculptor, has been commissioned to model the heads of Meissonier and M. Puvis de Chavannes for the proposed medal.

* Since this was written it appears, on the authority of a correspondent of the *Pall Mall Gazette*, that M. Zola has resigned, along with some others of the committee.

THE ARCHITECTURAL ASSOCIATION:

The Sanitation of Hospitals and Infirmaries.

THE ordinary fortnightly meeting for the present session of the Architectural Association was held on the 23rd ult., in the meeting-room of the Royal Institute of British Architects, Mr. E. W. Mountford (President) in the chair.

The following thirty-six new members were elected, viz., Messrs. L. D. Philpot, F. J. O. Smith, H. A. Chapman, C. Bree, G. B. Carvill, P. W. Cleave, J. S. Dunn, J. R. Ireson, C. Martin, A. Smithers, E. W. Allfrey, G. Bailey, N. C. Bathurst, T. Bee, A. R. Carey, E. F. Cobb, C. F. Dawson, R. E. Eddison, H. C. R. Hide, E. T. Marriott, C. H. Fowler, H. Mennie, R. J. A. Shield, R. S. Balfour, P. R. Bradford, H. R. Creighton, V. Esch, F. V. Forrest, G. T. Forrest, S. J. Halse, E. C. Haskins, E. W. Hobkiry, A. G. Pile, E. W. Pugh, F. C. Thomson, and S. Towse.

Mr. Keith D. Young then read the following paper entitled "The Sanitation of Hospitals and Infirmaries:—

The question will no doubt have occurred to many of you, what is there in the sanitary conditions of a hospital which so differentiates it from an ordinary dwelling-house as to render it necessary or desirable to treat it as a subject in itself? The essentials of sanitation, a clean and dry site, substantial and dry walls, a roof that is weather-tight, and drainage and plumbing arrangements of sound construction and properly devised, surely these are as necessary to the smallest cottage as to the largest hospital. This is all perfectly true; but there are conditions affecting the health of the inmates of a hospital which are to be found in no other kind of building, and which lie at the root of all questions of hospital sanitation. And it is upon these special conditions peculiar to hospitals that I propose to speak to you this evening.

In the first place, then, it is essential that we should have a clear understanding of what a hospital is: simple as this may appear, it is, nevertheless, the very root of the whole matter, and the want of a true knowledge of it has been and still is the cause of much disaster.

For our purpose to-night it will suffice if we divide hospitals into two classes: 1st, those which exist for the benefit of the patients, and 2nd, those which exist for the protection of the community. In the first class are comprised all those hospitals known broadly as general hospitals, including also the majority of special hospitals; and, in the second, hospitals for the treatment of infectious fevers.

In the first class then, we have a group of buildings which are devoted to the treatment of sick and injured poor—eleemosynary establishments, the first and most important function of which is charity. In these hospitals a large number of patients are gathered together, very often literally under one roof. Without such a grouping of large numbers of patients in one building or one group of buildings, it would be impossible to extend the benefits of medical and surgical relief to anything like the numbers of patients needing help, and as it, is the struggle for existence is, as you possibly know, hard enough. But the point to which I wish to draw your attention is this:—That it is not to the advantage of the patients that they should be congregated together in large buildings or in large wards; but, on the contrary, this very fact is an element of grave danger to the patients themselves. To put the matter plainly, the ideal hospital is one in which each patient should be treated in a ward by himself, entirely cut off from all possibility ot aërial connexion with any other ward. This is of course an economic impossibility, and it is the function of hospital sanitation to combat the dangers involved by the necessity of grouping large numbers of sick together.

I cannot do better than quote to you words written just thirty years ago, by Sir John Simon, in a report on Hospital Hygiene, to the Privy Council.

"The rules of hospital hygiene are (he says) in principle simple enough. That which makes the healthiest house makes likewise the healthiest hospital — the same fastidious and universal cleanliness, the same never-ceasing vigilance against the thousand forms in which dirt may disguise itself, in air and soil and water, in walls and floors and ceilings, in dress and bedding and furniture, in pots and pans and pails, in sinks and drains and dustbins. It is but the same principle of management, but with immeasurably greater vigilance and skill; for the establishment which has to be kept in such exquisite perfection of cleanliness is an establishment which never rests from fouling itself; nor are there any products of its foulness—not even the least odorous of such products—which ought not to be regarded as poisons."

The air of a hospital ward is liable to contamination from the following causes:—

1. The evacuations or effluvia from the bodies and excreta of patients.

2. The presence of suppurating wounds with their necessary dressings, poultices, &c.

3. Foul linen, bedclothes, &c.

And these necessary and unavoidable conditions common to all hospitals may be aggravated and their danger intensified by:—

a. Insufficient air space.

b. Insufficient ventilation.

c. Inadequate or improper arrangements for the removal of refuse of all sorts.

d. Faulty arrangement of buildings.

To illustrate the truth of these propositions, I will take two examples of hospitals which may serve as object-lessons in hospital hygiene.

My first example is the famous old Hôtel Dieu at Paris; often as this remarkable, I might almost say unique, building has been described, I think the lessons to be learnt from its history are so valuable, that I need not apologise for bringing it to your notice this evening.

I have here a plan of one floor of part of the Hôtel Dieu as it existed at the latter end of the eighteenth century. Howard, who visited this hospital in the year 1783, says of it and its auxiliary, the Hospital of St. Louis, that "they are the two worst hospitals I have ever visited. They were so crowded that formerly I have often seen five or six in one bed, and some of them dying." Tenon, whose memoir on the hospitals of Paris was published in 1758, says, "In the middle are placed the most infectious departments, such as clothes stores, mortuaries, dissecting-rooms; they (*i.e.*, the patients) are contained in four or five floors of wards joined together and without ventilation, wards surrounded by rooms for the staff which cool and shade them; where the staircases are insufficient; where the sole and only promenade is a place encumbered with drying-grounds and linen in course of evaporation; a monstrous pile more fit to prolong sickness, to destroy, than to re-establish and preserve health."

Look for a moment at the plan, with the vast ward running the whole length of the building, and containing 168 beds, of which 118 were for four patients each, giving a grand total of 552 patients, and then note that on the south side there are no windows at all, whilst on the north the windows must nearly all have had their sills above the ceilings of the adjacent rooms. This sort of thing was repeated on three upper floors with slight variations, and in addition to this building there were other wards on the opposite bank of the Seine, and on one of the bridges connecting the two sides.

The latrines were in close proximity to the wards, were insufficient in number, and are described by M. Tenon as masses of ordure, and the extent to which infection must penetrate the wards as inexpressible. Within the walls of this vast pest-house were gathered not only ordinary sick, but patients suffering from infectious and contagious diseases of all sorts, lying-in women and lunatics. And the immediate result of this state of things was that one patient out of every four died. You have here, then, every defect by which the structure of a hospital can contribute to the destruction rather than the preservation of life, and you see the result.

My second example is the old Lincoln County Hospital. I have chosen this in order that I may

contrast with it the building which replaced it, and which is still one of the best examples, twenty years old though it be, of a good county hospital.

In 1863, when this hospital was inspected by Mr. Timothy Holmes, he found that in consequence of a severe outbreak of erysipelas and other septic diseases certain alterations had been made in the structure and its drainage, which, it was hoped, would remedy the evils referred to. The hospital itself he describes as a building of irregular structure, a great part of it being nearly a century old. Like most hospitals of that period it was "composed of small wards not so much ill-provided with window space as having their windows improvidently placed for hospital purposes, the windows being wide and low, and at one or at two contiguous ends of the wards, so that it became necessary to crowd the beds together away from the windows." He notes also that in the older part of the hospital the floors were of plaster, than which a worse material for the purpose can scarcely be imagined. The hopes for the better future of the hospital expressed in Mr. Holmes' report were doomed to disappointment, for in succeeding years the recurrence of pyæmia was so persistent that it became obvious that nothing short of demolition would suffice to root out the evil. Here again, there can be no doubt that the structure itself was to blame. The number of small ill-ventilated wards, all in intimate air connexion with one another, was at the root of the difficulty. Septic disease does not readily spread about a hospital if the wards are properly separated one from the other and efficiently ventilated.

Contrast this with the plan of the present hospital, the work of my friend, Mr. Alexander Graham. Note the long and narrow wards, each bed with its proper complement of light and air, the offices properly disconnected from the wards, the latter from the administrative offices, and the laundry and mortuary duly isolated from every other part.

Let us now take in order the various points which I have mentioned as tending to aggravate and intensify the necessary processes of fouling which must go on in all hospitals.

Insufficiency of air-space and insufficient ventilation are closely allied, and must be considered together. Air-space, indeed, is of little value by itself unless it is accompanied by ample means of ventilation. And by air-space I mean not only cubic space but floor-space; a most important point to note. It is useless to supply your patients with a generous amount of cubic space unless you first see that they have sufficient floor area. Of the importance of free ventilation the experience of great wars is of the utmost value. A very striking case occurred during the Franco-German War—I believe in Paris—where it happened that a church and a slaughter-house were about the same time converted into wards for the reception of wounded soldiers. In the church gangrene broke out, and the mortality among the men was very heavy. In the slaughter-house, although the cubic-space was many times less per man than in the church, the cases did well and septic disease was not seen.

The essential point of difference in the two buildings was this. The church was a solid building with windows high up in the walls, and very little means of ventilation; whilst the slaughter-house was a mere shed, with louvre-boarded sides, freely swept with air from end to end. This point is further illustrated by the experience of hut hospitals, as compared with wards improvised in permanent buildings, as far back as the Crimean War and in the Civil War in America; which led many experienced surgeons to the conclusion that hospitals should always be temporary structures which should be destroyed at frequent intervals.

The question of ventilation cannot be considered apart from that of warming. The two are inter-dependent and cannot be separated.

Ventilation, then, means the supply of fresh air, warmed to the requisite temperature, and in sufficient volume to preserve a given standard of purity without producing draughts. The rule generally adopted in practice is that each patient should have a supply of 3,000 cubic feet of air per hour. This amount is requisite in order that the total impurity of the air may not exceed ·6 per 1,000. To accomplish this without draught, the air of the ward should be changed not oftener than three times per hour, which gives a minimum allowance of cubic space of 1,000 ft. per head. It is very difficult to lay down any fixed rules for determining the necessary allowance of cubic space. The nature of the disease treated, and the situation of the hospital, must be taken into consideration.

In a country hospital, where the cases are for the most part of a mild or chronic nature and the site is open, 1,000 ft. may often suffice. Where the average of acute cases is greater and a hospital is in the centre of a big town, more cubic space is required; and in hospitals in manufacturing towns, where severe surgical cases are frequent, I think 2,000 ft. is not excessive. The tendency to draft-off patients to convalescent hospitals as soon as they are fit to be removed, and so to keep the wards full of acute cases, is an element that must be taken into consideration now-a-days.

Ventilation is commonly divided into two classes—natural ventilation and mechanical or artificial ventilation. In natural ventilation the agency of windows and other openings, aided by the upcast power of the smoke-flues from open grates, is relied upon. In artificial ventilation the air is either pumped in by mechanical appliances and allowed to escape through openings or shafts constructed for the purpose, or it is sucked out either by fans or by the aspirating power of heated shafts. In either case the air must be warmed before it enters the ward.

It would be impossible for me to describe the many systems which have been devised for the ventilation of wards by mechanical means in the time we have at our disposal this evening. The object, however, of each is practically the same; namely, to ensure a regular and automatic change of air in the ward by mechanical means, altogether independent of windows.

The question which concerns us is this: Is there any evidence to prove that wards cannot be kept sufficiently sweet and healthy without recourse to expensive automatic appliances? So far as the experience of hospitals in this country goes, I think that not only is there no such evidence, but that there is some very definite evidence in support of the exact converse. There is a case cited by Dr. Bristowe and Mr. Holmes in the report to which I have before alluded, which goes to prove that mechanical ventilation can become a positive evil. I allude to the York County Hospital, which, when it was erected, was furnished with an apparatus for warming and ventilating by a mechanical process by which the air was warmed in the basement and driven into the wards by the aid of a steam-engine, the vitiated air being carried off by shafts warmed by hot pipes. The wards were not provided with fireplaces, and the windows were mere apertures for light, and were not made to open. This system remained in work for nine years. During that time it was said that the wards were always close, sickly, and even offiensive; and erysipelas increased to such an extent, and proved so often fatal, that the surgeons gave up operating altogether, preferring to abandon their patients to disease rather than risk operations with almost certainly fatal results. The system was abandoned, fireplaces constructed and windows made to open. When this was done erysipelas disappeared, and the health of the hospital became what it ought to be.

No doubt in this case the apparatus itself was deficient. I give the case for what it is worth; but it is not without its value if only to show how mischievous such a system can be if improperly devised.

To return to our question: Is artificial ventilation necessary? To prove that it is necessary we must assume that the ordinary means of ventilating by open windows is inadequate. Now, I venture to affirm that there is no evidence whatever in support of such an assumption. A distinguished Paris surgeon, Dr. Le Fort, in 1862 published a Report on Hospital Hygiene. He there compares the mortality in London hospitals with that of the Paris hospitals, very much to the disadvantage of the latter; and professes himself decidedly in favour of the natural means of ventilation adopted in London to the artificial systems in vogue in some Paris hospitals. But he says one need not go to England to search for means of comparison between the two systems; for the two hospitals in Paris where the mortality is greatest are precisely those in which artificial ventilation is employed. And this, remember, was at a time when antiseptic treatment was unknown, and the paramount importance of cleanliness was not recognised as it is to-day.

The matter appears to me to be very fairly stated by Sir Douglas Galton in his book on "Hospital Construction." "The system of propulsion for hospital ventilation (he writes) has not found general favour with hospital architects or managers in this country. There is one very patent and valid reason, which is that in this climate windows can be kept open; and when windows are open the volume of fresh air which passes through a ward will be at least twenty times greater than either the theoretical 3,000 cubic feet per hour, or even the 5,000 or 6,000 cubic feet, which some of these systems profess to furnish, without entailing the large expenditure of fuel necessary for moving a large volume of air."*

So, also, Dr. Bristowe and Mr. Holmes, in the report to which I have already alluded. "No amount of cubic feet of space, no plan of building, no artificial system, no combination of these adjuncts to a good ventilation has ever been found to replace open doors, windows, and fireplaces, while provided with the latter, which are the essentials of good ventilation, many old crowded defective hospitals have maintained for a long series of years an amount of success which the most eminent examples of scientific construction have never found practicable."

Everyone who has any experience of hospitals in this country knows that there are very few days in the year during which ward windows cannot be kept open—and I cannot think it justifiable for the sake of those few days to establish a complicated system, involving a certain amount of skilled labour in working and considerable cost for maintenance; a system, moreover, which must involve the construction of a number of shafts, all of which, unless kept scrupulously clean, must become harbours for filth and a constant menace to the health of the patients.

If I were to presume to lay down rules for the proper method of warming and ventilating a ward, I should say, apply your warmth, or the greater part of it, around the outside walls of the ward, where the greatest leakage takes place; whether the method be by steam or hot water, take care that every pipe or coil is so placed that it can be cleaned easily and all round; if any arrangement is made for the admission of fresh air at the back of a coil, see that the shaft can be readily got at and cleaned; and let no shaft for the passage of air be longer than the thickness of the outside wall.

Before I leave this subject of ventilation, there is one special point it is necessary to notice. This is the sterilisation of air from fever wards. There is one kind of fever, and one only, of which it can be said that the sterilisation of air expelled from the wards is necessary in the interests of public health, and that is small-pox, a disease of which we have convincing proof that it can and does spread beyond the walls of the hospital; that the specific infection of it is in fact air-borne. And for this reason it is distinctly desirable that some means should be devised for rendering innocuous the air from the wards. The nearest approach to the accomplishment of this task has been made at the Bradford Corporation Hospital, where, under the direction of the architects, Messrs. Morley & Woodhouse, an apparatus has been constructed, and since patented by Mr. Edward Oldroyd. The system, to describe it very briefly, is this: Fresh air, capable of being warmed when necessary by passing over hot-water pipes, is admitted to the wards in the floor at the foot of each bed, and also at certain points in the opposite wall. The whole of the vitiated air is drawn from the ward through openings at the ceiling-level into a trench, at one end of which is a powerful furnace; part of this air is used to promote the combustion of the fire, the remainder being passed through the furnace and exposed to a temperature estimated to be 800 deg. Far. All the windows in the ward are hermetically sealed. For sufficient reasons I am not able to put before you any statistics as to the success of this system. The proof of success in an appliance of this kind is a matter for the bacteriologists and the microscope; and we have yet to see whether a ward constructed after this fashion fulfils every requirement, not only of the sterilisation of the air, but also as a suitable place for the treatment of small-pox. The point, however, I wish to impress upon you is that there is no justification whatever for applying such a system as this to wards for scarlatina, or any other infectious fever. The fact that scarlatina, the most important of these diseases, does not spread beyond the walls of the ward is well recognised; and this being

* As Mr. Young quotes Sir Douglas Galton, we may draw his attention to another passage in the same book, as follows:—"Whilst, however, it would seem to be in the highest degree imprudent to trust in any hospital entirely to ventilation by propulsion, there are conditions connected with the air of large towns, in winter especially, which apparently can only be removed by a system of propulsion, combined with purification of the air from dust and fog by a system of air washing. These conditions are so eminently unfavourable to patients suffering from bronchial diseases, phthisis, or any respiratory trouble, that it would seem expedient, if not essential, to provide at least one or two wards with such a means of purifying the air in general hospitals and workhouse infirmaries in large towns." It is to be feared, however, that this quotation would not have suited the general argument of the paper.—Ed.

so, the necessity for any system of sterilisation of air vanishes.

Our next point is that insanitary conditions may be produced by inadequate or ill-conceived arrangements for the removal of refuse. It can scarcely be necessary, nor indeed would there be time for me to enter in any detail into the principles of drainage. The methods of sound drainage are the same in a hospital as in any other building; and the neglect of them leads in both cases to similar disaster.

There are, however, some points special to hospital work which require to be noted; and there is other refuse besides what is carried away by the drains which equally requires to be disposed of with care. In every ward for acute disease there must always be a certain number of patients who are unable to get up, and who must perform every office of nature in bed. For the proper emptying and cleansing of the vessels necessary for these purposes there must be provided a sink, which is commonly called the slop-sink. The emptying and cleansing of these vessels is a duty which devolves on the nurse, and is one that is by no means free from danger. Enteric fever can unquestionably be contracted by a nurse whose hands get accidentally soiled, or who is perhaps not sufficiently careful while carrying out her work. The sink, therefore, should be so constructed that the risk of splashing is, if not abolished, reduced to a minimum, while at the same time a copious flush of water should be provided. The only slop-sink that I know in which the difficulties of the situation are intelligently met is the one devised by Professor McHardy, and called after him by the patentees, Messrs. Dent & Hellyer. The two diagrams kindly lent me by Mr. Hellyer show a plan and section of this sink. The bed-pan is placed face downwards, with its nozzle inclining towards the outlet of the sink, a jet of water is then projected upwards from the rose underneath the sink and flushes out the whole pan, the pan itself being held in position by the india-rubber strips at the sides of the sink. To flush out the sink there is a flushing rim, the water to which is turned on by a separate handle. There is a separate jet for flushing out urinals, and a metal cradle was devised for holding these vessels; but the latter is an encumbrance, and is not at all necessary. The room in which this sink is fixed should be of sufficient size to hold not only the slop-sink itself but an ordinary porcelain sink for washing other vessels, such as spittoons, porringers, &c., and sufficient shelving to hold the ward crockery. As a rule these rooms are made far too small for the work that has to be done in them.

In all sanitary fittings, including water-closets, sinks, lavatories, and baths, simplicity of form and cleanly appearance are desirable. They should also be, as far as possible, self-cleansing, and all casings of every kind should be dispensed with. In operation theatres, where, above all things, minute and excessive cleanliness is of the last importance, it is well to make all shelves of glass, not only that the state of the underside as well as of the upper can be readily seen, but also because glass is perhaps the only material not liable to injury from the acids used in the theatre.

I have referred to kinds of refuse not liquid. I mean by that not only the household refuse, dust, ashes, kitchen-stuff, and so forth, but ward refuse, such as bandages, dressings, poultices, and the like. In a general hospital the ordinary household refuse may be consigned to the care of the parish dustman; but it should be collected and stored in iron bins for which a suitable shelter not near any ward should be provided, and it should be removed daily. Kitchen-stuff in a general hospital may also be separately stored and disposed of. But in a general hospital all the ward refuse, and in a fever hospital all refuse of every kind, should be burnt in a properly-constructed furnace. This furnace must be so constructed that the gases resulting from combustion are destroyed or decomposed before reaching the smoke-flue. Such an apparatus has been devised by Mr. Brophy, of the firm of Slater & Co., and is in use at the Middlesex and the London Fever Hospitals.

With regard to drainage generally, I will only add a word to impress upon you the extreme value of flushing. You can hardly have too much flushing power in hospital drains—or, for the matter of that, in any drains. If there is a laundry, the waste water can very well be taken to a flushing-tank, and utilised for flushing the drains by means of one of Mr. Roger Field's syphons. Of course, care must be taken to intercept the large quantity of shreds that invariably get detached from the clothes in the process of washing.

I now come to my last point, which was faulty arrangement of buildings. I have already indicated, when comparing the old and the new Lincoln Hospitals, the main features of malconstruction. What is called by Dr. Erichsen the "big house system" is the sort of plan upon which so many of the larger provincial hospitals and some of the London hospitals were built, notably University College Hospital, where Dr. Erichsen's well-known lectures on Hospitalism were delivered. In extreme contrast to this we have such a building as the Eppendorf Hospital at Hamburg, where every ward is an absolutely isolated building, and not even a covered way exists on the site. The enormous cost, both for land, buildings, and administration, of such a system could only be justified on grounds of absolute necessity. For myself, I fail to see the necessity; nor do I know of any sufficient reason for limiting the wards to one story in height, as is done at many other recent foreign hospitals besides the Hamburg one. Provided you so construct your wards that each ward is cut off from direct air communication with the other wards and with the other parts of the hospital, provided that there is ample open space for all purposes of light and ventilation, it seems to me to be quite immaterial whether they are two or three stories high. As an example of how wards should be isolated one from the other, I have here a plan of part of the new hospital now in course of erection at Derby. The wards are cut off from the corridor and from the staircase by short lobbies, which are, in fact, but covered bridges, with only just sufficient height for head room, and with free air space between the roof of one and the floor of that above. The corridor must, of course, be kept warmed at or about the same temperature as the wards; if this is done, and ample inlets for air are provided in the latter, there will be no suction of air from corridor to ward. The ward itself must be as simple in construction, and as cleanable in all its parts, as it is possible to make it, and should contain nothing but the most necessary furniture. Suitable store-rooms must therefore be provided outside the ward for food, for linen, and for patients' clothes, and an orderly closet for brooms, pails, and other things necessary for daily use in the ward cleaning. Mouldings must find no place in a ward or in any of its offices; angles, whether vertical or horizontal, must wherever possible be hollowed; in vertical angles to promote circulation of air and avoid stagnant corners, and in horizontal angles for facility of cleaning.

In the construction of ward-floors I think solid or so-called fireproof construction is essential—and after much consideration and comparison of different kinds of floor surfaces I am inclined to think that carefully-laid terrazzo is the best thing to be had. Hard-wood floors, laid in block fashion, are apt to tilt up with the weight of a bed, plus a heavy patient, and the joints, however well made, will open in places. Terrazzo, when well laid and when care is taken to have a sufficient thickness of concrete over the iron joists, gives a solid, homogeneous surface that is hard to beat. I know I shall be told that it is cold to the feet; but any slight inconvenience that may be felt from this cause can very easily be remedied.

A point of importance in regard to windows is that a window should always be put between the end bed and the end wall. This window may be as narrow as you like, but it must not be omitted. The necessity for this arises from the fact that these corner beds have been found to be less favourable to the well-being of patients than the other beds, owing, no doubt, to defective circulation of air round about the patient. The water-closets and sink-rooms must, of course, properly be cut off by cross-ventilated lobbies from the wards; this point is pretty generally recognised to-day. But what appears to be too often lost sight of is, that if it is necessary to take this precaution with regard to one closet, or set of closets, it is equally necessary to do it with every other. In a late competition for a large hospital I remarked several instances of the neglect of this obvious principle. In one case a two-bed ward had its closet opening practically into the ward, and in another otherwise excellent plan the water-closet for the use of the nurses opened directly out of the ward corridor.

I fear I cannot give you any counsel of perfection for the finishing of wall surfaces in wards. The perfect wall-surface has yet to be invented; meantime, I doubt if we can do better than a good Keene's cement surface painted and varnished.

If it is necessary to isolate wards from one another, it is of vastly more importance to separate the out-patient department, the operation-room, the laundry, and the mortuary.

The out-patient department must be a separate building, and the only reason for any covered communication existing between it and the wards is, that the dispensary must be in touch with both. Or, to put it in another way, the dispensary must be part of the out-patient department, and to avoid having a second dispensary in the hospital proper, it must be also accessible to the nurses.

Equally necessary is it that the operation-room should be carefully isolated from all possible chance of air-borne contamination from any other part of the hospital. So far has this principle been carried abroad, that in one hospital in France the operation-room is a detached building in the garden, and patients are conveyed to it through the open air in a specially-constructed litter. This is carrying asepticism to an extreme that we should probably find would not be upheld by any surgeon in this country. But I think it will be agreed that where possible the operation-room should be a one-story building, and cut off by a lobby from direct communication with the main corridor.

Inside the operation-theatre, everything that makes for perfect cleanliness and consequent asepticism must remain supreme. A floor of the best terrazzo, walls either of marble or enamelled tiles, and well-painted and varnished cement ceiling, metal window-frames flush with the walls, and hard-wood doors, every part must be so made that the whole room can be if necessary swilled down with a hose. The fittings need careful consideration. For shelves the best material is glass, for reasons previously stated. Neither pipes or anything else must be fixed up against the wall so that they cannot be readily cleaned all round.

The laundry again must be an isolated building; it may be connected with the administration block by a covered way open at the sides, but even this I do not regard as an absolute necessity.

The mortuary building should be as far away from the rest of the hospital as possible. An essential part of the mortuary building is the post-mortem room, and here the aseptic precautions which in the operation-room are necessary for the sake of the patient are, to a lesser extent, perhaps, necessary for the sake of the medical officer. A post-mortem room should be as cleanable in all its parts as an operation-room; and the materials used in its construction, while less costly, should be of a hard, non-absorbent nature. For the walls glazed bricks, and for the floors cement or asphalte are most suitable, while the table itself should be of a hard marble, polished, and supported on a framework of iron. The floor should be drained by an open channel provided with an efficient flushing-tank and covered with a movable iron grating.

In conclusion, let me try to summarise the essentials of hospital hygiene so far as the building is concerned. Perfect cleanliness in every part is the keynote, the beginning and the end of hospital construction, and to this every part must lend its aid. There must be no lurking-places for dust, no hidden recesses where foul things may be stored out of sight, no avoidable projections, or ledges, or mouldings to catch the dust, no cased-in pipes or shafts for foul linen or lifts.

The patients must be safeguarded from infection from each other, from the out-patient department, the laundry, and the mortuary; from the evil effects of ground-air, foul drains, or dust-bins. And in a word, every part of the establishment must be contrived with a view to facilitate that "exquisite perfection of cleanliness" which is the true secret of a healthy hospital.

Mr. Alexander Graham proposed a vote of thanks to Mr. Keith Young for his very lucid and admirable paper. The word sanitation, which was the key-note that evening, was a modern word, almost belonging to the present generation. When Sir John Pringle wrote on the subject 150 years ago, sanitary science, as understood in those days, was hardly a science at all. And he is credited with having said that he could more easily effect a cure in an old ruined building with broken windows, than in any hospital of his time. The lessons inculcated, however, did not have very much weight, for in the time of the Peninsular War the condition of things was very much the same, and it remained so until the close of the Crimean War. The first hospitals, which might be called proper hospitals, were military ones. He himself took Sir Gilbert Scott to Hounslow to show him one of the first hospitals built on sensible principles, and shortly

after that Scott designed the great Leeds Infirmary. Since then, he understood, many alterations had been made in that Infirmary, and no doubt if Sir Gilbert Scott had copied the simple arrangements of the Hounslow Hospital the errors which had crept in at Leeds would not have occurred. Mr. Young had divided hospitals into different classes, but he had not sub-divided them into town and country hospitals. In designing a town hospital one was very much hampered for want of space. There was an old rule that not more than fifty beds should be put on an acre of land, but that was almost impossible in planning hospitals for large towns. The question of ventilation was of vast importance, but the difficulty was to avoid draught. To change the air three times an hour could be easily effected by ordinary means, but it was very difficult to lay down any fixed rule on the subject. In designing a hospital ward, floor space was a much better unit to work to than cubic space, because cubic space would regulate itself by height. De Chaumont had laid it down that over 12 ft. in height was unnecessary, and that experience showed it was impossible to control the air in an apartment of any great height. He was very glad to hear Mr. Young's remarks about natural ventilation. Experience taught them that if they trusted mainly to their windows and fireplaces they would always get a ventilating power at work both in summer and winter. In regard to the inlets, there was no difficulty, because in the case of the wards the walls would be external ones, and inlets could be put wherever they were desired. There was a great division of opinion in regard to where inlets should be placed; but it mattered very little; if they were low down where the pipes were the air could be warmed, while if they were a little above the heating the circulation was equally good. He was pleased to hear Mr. Young condemn some of the mechanical systems, for he never heard of one which was perfect in action, and he was sure they were very expensive. With regard to the necessity for sterilising the air of smallpox wards, he had no special knowledge, but recently where a fever ward had to be erected not far from a smallpox ward, he advised that the smallpox ward should be taken down before the fever ward was put up. With regard to drainage, they knew that what applied to a house or cotiage would apply equally well to a hospital. There was, in fact, no better school for the young architect to gain his experience in the drainage of an ordinary house than to have a small hospital to build, because he would not only profit by what he learnt from his own work, but he would come into contact with medical authorities and others, and in that way obtain a vast amount of information which would be useful to him in his general practice. The fittings of a hospital were matters on which there was a great diversity of opinion, but if there was one fitting that deserved success it was the very excellent slop-sink of Professor McHardy. Referring to floors, terrazzo he considered to be cold to the feet. He had never used any, because he had always advocated the use of teak for floors which had undergone the paraffin process. He would be glad, however, if the terrazzo floors answered the purpose for which they were intended. In one of the hospitals of New York he noticed tiles used for ward floors, and being red they had a warm appearance, but he felt they must be cold for patients. As to walls, he was glad to hear Mr. Young advocate a Keene's cement-surface, and the painting and varnishing of such a surface was, in his opinion, the best mode of treatment. The use of glass had extended very much, and shelves made of that substance should always be used if possible. He believed that glass had been utilised for the walls of operating-rooms, but he was not aware whether it answered. With regard to mortuary buildings, nothing could be better than the use of glazed bricks and asphalte for floors recommended by Mr. Young, with plenty of means of flushing. There was one matter he could not help thinking they should always bear in mind, though, perhaps, it might be a question of sentiment more than anything else. They should remember, in planning their structures, that a mental influence was exercised on people in bad health by cheerful objects out of doors. It was well, for instance, that the patient should not be able to see anything ugly in the surroundings. There were plenty of cheerful things to be seen in a ward, and, if there was any ugly object outside, it was better that the ward should be so placed that the patient should not notice it. Some time ago he was called upon by a committee in a country town to advise about the plan of a small hospital. Before looking at any of the designs, he went to inspect the site, when he found that a very strong shadow was cast on it by high buildings close to the boundary. He made a sketch of the shadow, and decided that it should not enter the wards, for the moving of a black shadow across a ward would not help sick persons towards recovery. He went again in the afternoon, and marked the shadow, and afterwards suggested that the building should be shifted, so that the shadow should never be in the ward. In all hospital planning, young architects were apt to consider their elevation first, and their planning afterwards. The plan was everything, and when that was finished, with all the doors, windows, and every detail that might contribute to the well-being of the hospital fully considered, a good architect would then be able to make a satisfactory elevation under any circumstances.

Mr. Gordon Smith remarked that in one sense he could not claim to be a high authority on hospitals, for he had never built one. He had seen a great many, certainly, and had taken a great deal of interest in the subject, and he had had occasion, during a somewhat long career, to discuss hospital arrangements with a great many architects and medical authorities. He felt almost afraid to touch upon the important question of ventilation, because, whatever one said in regard to it was apt, in these days of competition, to be slightly distorted. In the main, however, he endorsed all that Mr. Young had said in his condemnation of mechanical ventilation, and he felt that the best system was to depend almost entirely upon windows, fireplaces, and doors. In any reasonably well-constructed ward, with the usual amount of windows properly arranged, there should not be any difficulty whatever in effectually ventilating the ward, without any appliances other than those referred to. There was sometimes a little difficulty in getting people to open the windows sufficiently, but there ought to be in every hospital someone to act as an officer of hygiene, whose duty it should be to see that all the details put there by the architect were judiciously used. He would like to suggest also that, when the architect finished the building, he should leave carefully-prepared printed instructions as to how the various appliances should be used. The sterilisation of ward air had been referred to, but he did not think there was any occasion for it, except in the case of smallpox wards. There was no need for it in other wards, and as far as efforts had been made, hitherto, to effect such sterilisation, he believed they had only been attended with partial success. He would like to support what Mr. Graham had said in regard to cubic space. Certainly the floor space, and the distance apart of beds, were the chief factors, and they came distinctly before cubic space. When the Local Government Board were preparing the revised instructions about infectious hospital construction, they accepted the generally-recognised amount of cubic space per patient at 2,000 ft. It had been always laid down that there should be 144 square feet of floor space and 12 ft. of wall space to each bed. That was on the supposition that the wards were to be 24 ft. wide, with a 12 ft. wall space to each bed; but in order to make up the 2,000 cubic ft. a height of 14 ft. was required. In revising this arrangement, it was decided to recommend that the width of the wards should be increased to 26 ft., and their height reduced to 13 ft., and thus the patients get the advantage of increased floor space without any diminution of cubic space. In regard to cleanliness, there was a good plan adopted in one or two foreign hospitals he had seen, but which would probably be very difficult to adopt in this country on account of the cost. That was to arrange hospitals so that they might always have a vacant ward lying "fallow," the windows being left for a time continually wide open, thus allowing the ward to be thoroughly aërated. In conclusion, he had very much pleasure in seconding the vote of thanks to Mr. Young.

Dr. Pasteur (Lecturer on Public Health at the Middlesex Hospital) said he had listened with great interest to the admirable discourse of Mr. Young, and it had struck him how thoroughly that gentleman had grasped what it was most essential that all architects should grasp in constructing hospitals—namely, the nature of the dangers one had to guard against. It was of paramount importance to attain cleanliness; not cleanliness in the ordinary sense of the word, but, a degree of cleanliness which would stand the test of the microscope. Everything must be clean, from the air supplied to the wards to the materials of which the wards were constructed. It was not only necessary that these should be clean when put down, but that they should continue clean. Hence the importance of using materials which were as far as possible non-absorbent for facing and flooring wards. If that was done, it seemed to him that a "fallow" ward should not be necessary, because non-absorbent walls, &c., could be cleansed so as not to require the ward to be laid by for a certain period. The examples of the monstrous iniquities that had been brought before them in connexion with the Hôtel Dieu and of the old Lincoln Hospital were fortunately things which could not occur in the present day. No doubt they came in contact with many examples of harm done to hospital inmates through defects of construction or faulty arrangements. He believed there was not a hospital physician or surgeon who did not know of certain wards or beds with a shady reputation, which could be traced to some neglect in administration or some fault of construction. He had known of a bed in which patients were constantly getting erysipelas. The matter baffled inquiry for a long time, until a layman discovered the cause, in the shape of a dust-bin in the area, just below the window which opened on to the bed, and on the removal of this dust-bin the erysipelas disappeared from that bed. Not many years ago he had to inquire into the cause of recurrent outbreaks of diphtheria in the wards of a London hospital. In this case there was not much difficulty in finding faulty sanitary arrangements. When the drains were put right the diphtheria disappeared entirely from one of the wards, but in another ward, where diphtheria continued to prevail, nothing appeared to remove it until the flooring was ripped up, the space between disinfected, and a parquet flooring put down. With respect to the terrazzo flooring, he had the pleasure not long since of visiting, with Mr. Young, the magnificent infirmary of which the plan was in front of them. He had been delighted with almost everything he saw in this very perfect hospital, but confessed he had had an unpleasant impression on walking over the hard and cold ward floors. Their hardness constituted a possible source of serious injury to patients falling or throwing themselves out of bed. He did not know if these floors were non-absorbent. If they were not, this would, in his opinion, constitute another objection to their use. In conclusion, he believed that the man who looked most into the details of hospital construction, and troubled himself about them, would obtain the best results—*i.e.*, build the healthiest hospitals.

The Chairman said they had had a good deal of opinions reflecting on mechanical ventilation, but there was a gentleman present who, he believed, was rather in favour of them. He referred to Mr. Henman, of Birmingham, now building the large General Hospital there.

Mr. William Henman had much pleasure in supporting the vote of thanks to Mr. Young for his excellent paper which embraced so many subjects requiring attention if good sanitation was to be secured in the design and construction of hospitals. One point of importance had not, however, been alluded to—that of aspect. It was a question upon which hospital architects, so far, did not appear to agree, but he was decidedly of opinion that in this country pavilion-wards should run as nearly as possible north and south, so that the sun's rays may fall on both sides—during part of the day at least. He was not sure that Mr. Young had adopted the best material in the Derby Infirmary for the floors of wards, for even if terrazzo was a substance impervious to moisture it was liable to condense moisture upon its surface, when there was a rise in temperature after a period of cold weather, unless the floors were heated from below, as was done on the Continent, and he feared that the health of the nurses might suffer from standing so long upon the cold hard surface unless supplied with slippers of more non-conducting material than they generally used. With regard to wall surfaces he had recently paid considerable attention to them, and had come to the conclusion that the employment of glazed materials was, generally speaking, a mistake. External walls were exposed to greater variation in temperature than even floors, and more readily condensed, not only the ordinary moisture in the internal atmosphere of the ward, but also the breath and exhalations of the patients, and therewith that organic matter which, with a proper system of ventilation and with walls of an amorphous, and therefore naturally warmer, substance, would be expelled by change of atmosphere. He had passed his hand over glazed wall surfaces and been surprised to find what an amount of dirt had really accumulated upon what appeared to be a clean

surface, and had also noticed moisture trickle down the face of glazed brickwork, and on arriving at a joint, being absorbed with all the impurities carried with it. At that late hour of the evening he scarcely dared enter upon the subject of ventilation, which was a large and very important one, and one on which he ventured to differ entirely from the views expressed by Mr. Young. He could only touch upon the subject at present, but those interested in the matter might ascertain his views more fully by perusing the paper he had read before the Leeds and Yorkshire Society of Architects, and which was published in the *Journal* of the Royal Institute of British Architects in the spring of this year. It appeared to him that a certain black pamphlet bearing a red cross on white ground, written he believed to prejudice people against what he and others were doing to practically utilise a scientific method of ventilation—must already have had effect upon the minds of previous speakers.* He had examined into all the systems and methods in use, and had visited a large number of hospitals for the purpose of ascertaining whether the so-called natural system did duty properly. In most cases he found the verdict against it, particularly at night, and when, as very frequently happened, the windows cannot be kept constantly open, then it was that wards got dreadfully stuffy. In Birmingham and other large cities the ordinary atmosphere was dirty and contaminated with manufacturing fumes, and the question therefore arose whether the air could be cleansed, and an adequate change be effected throughout the buildings by mechanical means. Mr. Young had spoken about a change of air three times per hour, but although that might be all which could be secured by so-called natural ventilation, without creating draughts, it was nothing like sufficient; yet he could assure them that by mechanical means, properly applied, it was possible to change the air of an apartment ten, twelve, or even fifteen times an hour, without causing unpleasant draughts. This he had proved by experiment in a building he had had specially erected. Two rooms of exactly the same size were equally supplied from one air-duct. In one room, provided with what he called a "spreader," one might sit in comfort for an indefinite time. In the other room, without such an appliance, it would be uncomfortable to remain even half-an-hour. This proved there was much in the method of applying any system of ventilation, and he did not doubt that by defective application in the past mechanical ventilation was now unjustly condemned; experience had, however, proved it could be successfully and economically applied. He was very glad the previous speaker had referred to particular beds in certain wards being unhealthy, and to the causes to which such had been traced, because such cases proved conclusively to his mind the necessity for a scientific system of ventilation by propulsion, to replace the haphazard means commonly, but erroneously, called natural, by which air—good or bad—was sucked in from no one knows where. In considering this subject in connexion with the new Birmingham General Hospital it was not only a question of having reliable ventilation throughout the buildings, but one of cost, and on that point the committee feel satisfied, because as a set-off there is a great saving of daily labour. There being no fireplaces, no coal had to be carried about; dirt was avoided, and no dustbin was required; and as there were neither steam nor hot-water heating-pipes in any habitable part there were no inaccessible places behind, where dirt could accumulate. As to the ducts and flues, they were all of large size, readily accessible, and provided with means for periodic cleansing. No trouble has been experienced in the several buildings in which the system has been carried out as it will be in the Birmingham Hospital, yet in some it has been in operation for the last three or four years. With regard to the purification of air passing out of hospitals, he agreed it was unnecessary, except for smallpox and possibly fever-wards, as only negative evidence had so far been forthcoming that scarlet fever and other diseases due to germ life are not conveyed by the atmosphere. In the case of smallpox it was essential to purify the air, it having been ascertained that it was undoubtedly conveyed by the atmosphere. His proposition was to adapt the system of air propulsion, and to place at the head of every bed an outlet with a screen somewhat similar to the screen used at the inlet, for it had been proved by careful bacteriological examination, that such screens eliminated germs from the atmosphere. In the building he had mentioned he was carrying out further experiments, and hoped to demonstrate that it is possible to purify the outgoing as well the incoming air, and in time to communicate the results of his experiments.

Dr. E. A. Fardon (Resident Medical Officer, Middlesex Hospital), remarked that he was extremely pleased to be able to follow the last speaker in regard to ventilation, because he appeared to be the only one who had ventured to speak with certainty as to his belief in the adequacy of artificial ventilation. He had never seen an artificial system which had been generally approved by the people who had to use it. He believed the importance attached to draughts or unequal temperature in wards of general hospitals was rather apt to be exaggerated, and there was little risk of the patient, under ordinary circumstances, catching cold when the surface of the skin was adequately protected from chills. As to air-space, the cost of the site would be very large in a city, and he knew of well-managed hospitals with certainly not more on an average than from 1,000 to 1,200 cubic feet of air per bed, where the results were as good as where there was double or treble that space allowed. Terrazzo was a beautiful substance for corridors, but when laid down for any length of time it was liable to fissure and fracture. He much preferred for wards a solid teak floor, well put together and subjected to some process to render the wood impervious. Walls with a glazed surface were usually damp, and took up dust. Cement covered with several coats of paint, and varnished, presented an admirable surface, but unless it was kept rubbed and polished the varnish was apt to deteriorate in time under the effect of the London atmosphere. For that reason he liked to see a wall painted and varnished to the height of an ordinary dado, which might be reached by the hand, while above was a distemper which could be renewed periodically. He might add that he was practically in accord with nine-tenths of what Mr. Young had said in his interesting paper.

Mr. Cole said he believed somewhat in mechanical ventilation, and with modern appliances a great deal more might be achieved than had been done in the past. For both inlet and exhaust an electrically-driven fan could be used at a small cost, and with the minimum of attention. He agreed that a painted and varnished dado with distemper above acted well for the walls of a hospital.

The vote of thanks on being put to the meeting, was carried by acclamation.

Mr. Young, in replying, said he should not attempt to follow Mr. Henman in his remarks on ventilation. There were several hospitals abroad with either cement or terrazzo flooring. The flooring at Derby was an experiment, undertaken under the advice of the medical staff, who had given considerable attention to the matter. One of the staff went to Hamburg and found the hospital there had its wards floored with terrazzo, though they were also under-warmed. If terrazzo flooring was proper for the patients the nurses could easily wear suitable shoes. The utmost possible credit was due to Mr. Henman for the great pains he was taking to arrive at a definite knowledge of what artificial or mechanical ventilation was going to do, and he, for one, would look forward to seeing the results of the work at Birmingham with exceeding interest. He had a perfectly open mind in the matter, and only wanted to do the best that could be done for the patients. A remark had been made about the evidence of the spread of infection from fever hospitals being merely negative, but there was certainly positive evidence that scarlatina did spread beyond the walls of a hospital.

The proceedings then terminated.

* They must be very ill-informed people, then, to be taken in by an anonymous pamphlet circulated by a trading firm.—ED.

COMPETITIONS.

PUBLIC LIBRARY, HAMPSTEAD.—The Public Library Commissioners for Hampstead have this week held a public examination of the plans and elevations of the proposed central public library, Hampstead, for which a site has been secured at the corner of Arkwright-road and Finchley-road. The competing architects are Messrs. Basil Champneys, Horace Field, T. Graham Jackson, and Arnold S. Taylor.

TOWER BRIDGE COMMEMORATION MEDAL.—The result of the competition for models of a medal to commemorate the opening of the Tower Bridge by the Prince of Wales has just been made known. The first premiated design is by Mr. F. Bowcher, 6, Clifton Hill Studios, St. John's Wood; the second being by Mr. G. G. Adams, F.S.A., Acton Green Lodge, Chiswick.

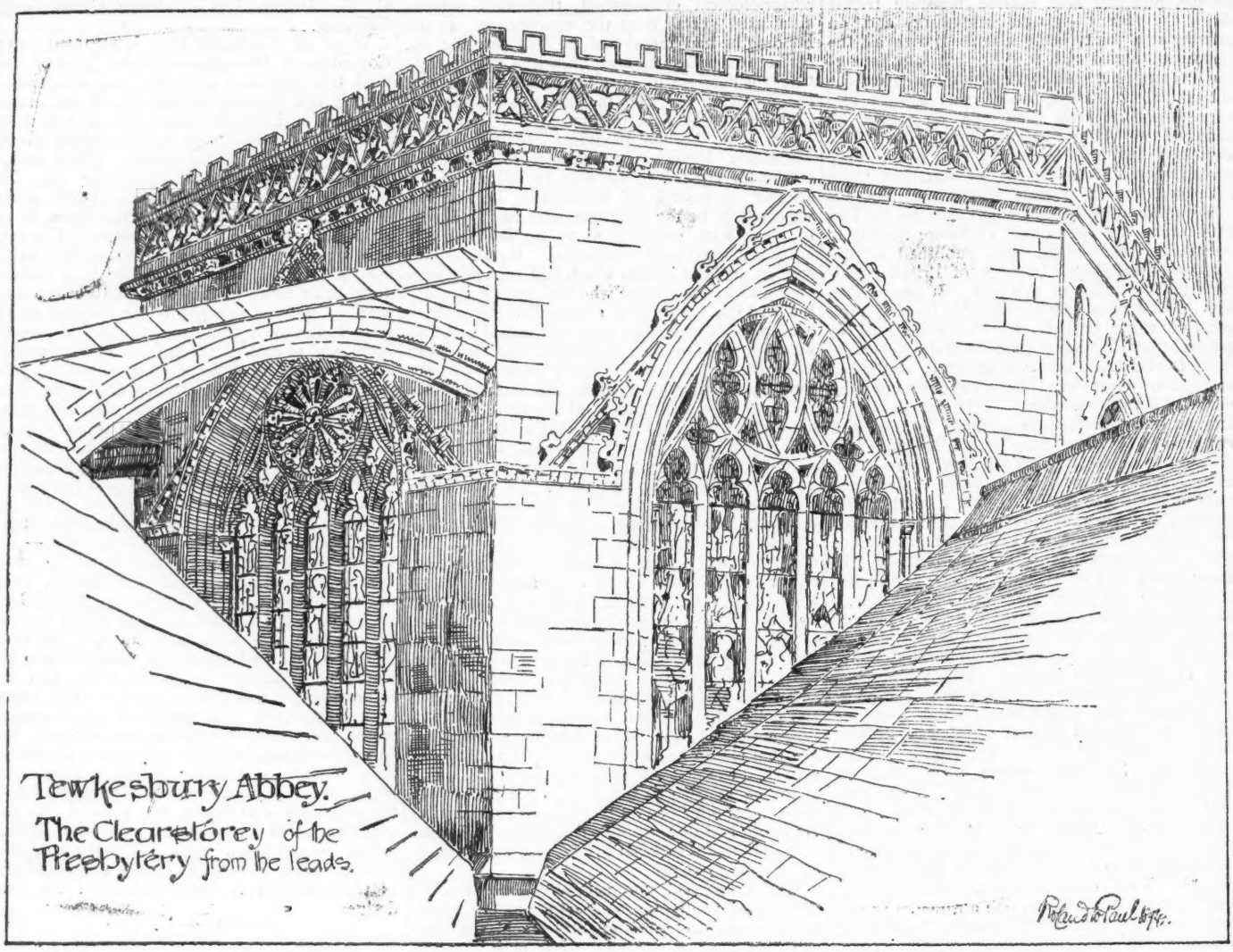
WEST OF ENGLAND EYE INFIRMARY.—The Committee of Management of the West of England Eye Infirmary at Exeter are proposing to erect a new building on the site of the present premises in Magdalen-street, and in August last they invited architects to send in designs in competition on instructions issued. These designs were to be delivered on November 30. The committee have appointed Mr. Charles Barry, F.S.A., as their assessor to advise them in the selection of the most suitable design. This competition is to be a dual one. From the designs sent in at first (which are to be to a scale of 16 ft. to an inch), not fewer than three, or more than six, will be selected by the assessor for the final competition (drawings to be 8 ft. to the inch), and to each of the architects so selected an honorarium of twenty-five guineas will be paid. The successful architect in the final competition is to be employed as architest to the building on the usual professional terms. The work is intended to be commenced at once, but if its commencement should be delayed for two years after the award, the architect is to be paid 100 guineas (in addition to the honorarium), and his design will then become the property of the committee.

MUNICIPAL BUILDINGS, COVENTRY.—The City Council of Coventry are about to invite designs for complete Municipal Buildings, which are to embrace the old historical St. Mary's Hall and some other ancient buildings which have for many years been used for municipal purposes. They invited by advertisement architects who had had some experience in similar work, and who were willing to compete, to send in their names with drawings or photographs of their executed works, and twenty-five names were sent in. The City Council have selected eight of the applicants, who, together with any Coventry architects who might desire to compete, will be supplied with the necessary instructions and plan of the site available. The City Council have been advised in the preparation of these instructions by Mr. Charles Barry, F.S.A., and have appointed him as their assessor in the selection of the best designs.

ARCHÆOLOGICAL SOCIETIES.

BRITISH ARCHÆOLOGICAL ASSOCIATION.—On the 21st ult. a meeting of the British Archæological Association was held, the Rev. J. Cave-Brown, M.A., in the chair. Mr. Way exhibited a series of antiquities, mostly found in Southwark, the most curious being a hand-pistol for the discharge of needles. There was also a bronze stylus of Roman date, having a spoon at the opposite end for melting wax for the writing-tablet. Dr. Fryer exhibited an inscribed ring found at Tyre. Mr. Loftus Brock, F.S.A., in referring to the number of jettons found in Europe, exhibited some procured on the Continent, struck by various municipal and corporate bodies for public use. Mr. Symons sent particulars of a curious article of pottery found at Hull. Lady Simons forwarded drawings of some crosses of very early date which have been met with at Lerwick. They are sepulchral in character. Mr. Metcalfe described a remarkable chest of Italian work which is now preserved in Sherborne Castle. Drawings of an early Norman inscribed tomb, with a description, were laid before meeting by Mr. C. Lynam. It is in Adderley Church, Salop, where an interesting and little-known monument of a priest exists in the modern building. A paper was then read by Dr. Fryer, on the discovery of manganese from abroad, which has been found near a smelting furnace attached to a Roman building near Cardiff. The chairman read a paper on a list of witnesses, appended to the records of a trial, 1176, relative to lands in the Isle of Thanet. It is of much local interest, since the names are 123 in number. The records form part of Campbell's Charters, in the British Museum, recently investigated by Mr. de Gray Birch, F.S.A. A paper was then read by Mr. R. B. Barrett on the ancient buildings on the Rock of Cashel, the cathedral, Hoar Abbey, and the remains of Holy Cross being described in detail, and their present condition referred to. The paper was illustrated by elaborate plans and drawings of the subjects described.

SURVEYORSHIP APPOINTMENT.—The Madron (Cornwall) Local Board and Urban Sanitary Authority have appointed Mr. J. Wm. Trounson, of Penzance, their Surveyor, and given him instructions to prepare the necessary plans, &c., for a water supply and sewerage scheme of Hea Moor District.



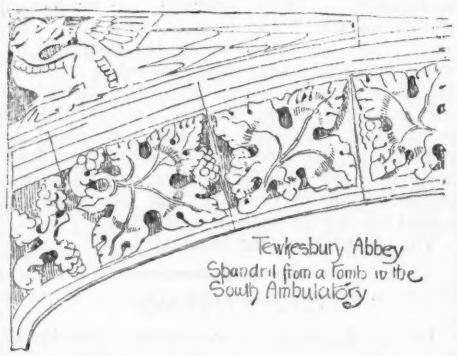
Illustrations.

TEWKESBURY ABBEY.*

THE major portion of the present Abbey Church of Tewkesbury dates from the Norman foundation of FitzHamon in 1087, during the abbacy of Geraldus. The church was consecrated and dedicated to the Virgin on November 20, 1123,† having been completed by Earl Robert, brother of Henry I., who married Mabel, daughter of FitzHamon, and thereby succeeded to the manor of Tewkesbury. It consisted of a nave of nine bays, with aisles, a north porch, a lofty central tower, aisleless transepts, with eastern apsidal chapels and a Presbytery of two bays, with a semi-hexagonal apse. The form of the later additions suggest the possibility of chapels projecting from the ambulatory, as at Norwich; but of that there is no existing evidence. The nave remains in its original state, with the exception of later windows and vaulting, and bears a strong resemblance to the nave of Gloucester Cathedral.‡ The central tower also stands, forming one of the finest examples in England of its period. The chapel eastward of the south transept exists, but the corresponding chapel on the north has been destroyed, to make room for larger chapels at a later period.

The second of the three great families who held the Manor of Tewkesbury was that of De Clare. Gilbert de Clare succeeded to the honor of Gloucester in 1221, and the Tewkesbury Manor remained in the De Clare family until the death of the tenth Earl, Gilbert, at the Battle of Bannockburn, 1314. The De Clare graves are still below the pavement of the Presbytery, arranged side by side opposite the "Warwick" chantry. The only stone remaining in the pavement is the matrix of the fine brass of Maud de Burgh, widow of Gilbert (iii.) de Clare. She died 1315. The graves were all carefully examined during the progress of the late restoration (1875).

The only portion of the Abbey Church which belongs to this period is the Chapel of St. Nicholas at the north-east angle of the north transept. The building originally extended the full length of the north front of the transept, and was entered from it by a deeply-moulded arch, the full thickness of the Norman wall, which has recently been opened out and restored. Unfortunately, what might be termed the nave of this chapel has been destroyed, but the traces against the transept-wall show it to have been divided into four equal bays and vaulted. At its north-east angle, incorporated with what now serves as a buttress, is a respond showing that this portion



was arcaded on its north side. The chapel is at this point spanned by a fine pointed arch, subdivided, and having a central column. All east of this remains in fairly perfect condition, and retains its vaulting and its wall arcading on the north; the windows, however, being insertions of Decorated date. On the south, almost at the angle of the Norman transept, are the remains of the pilaster buttress, corresponding to that existing on the north side, and showing conclusively that this chapel stood out clear of any other building, and existed before the Norman Chapel of the transept was destroyed. Its use has, we believe, never been satisfactorily explained. The present or eastern part is known as the Chapel of St. Nicholas, the destroyed portion that of St. Eustachius. It has been called also the Chapter House and the Lady Chapel. At Bristol a chapel known as the "Elder" Lady Chapel is attached to the east wall of the north transept, and bears some resemblance in its detail to the one at Tewkesbury.

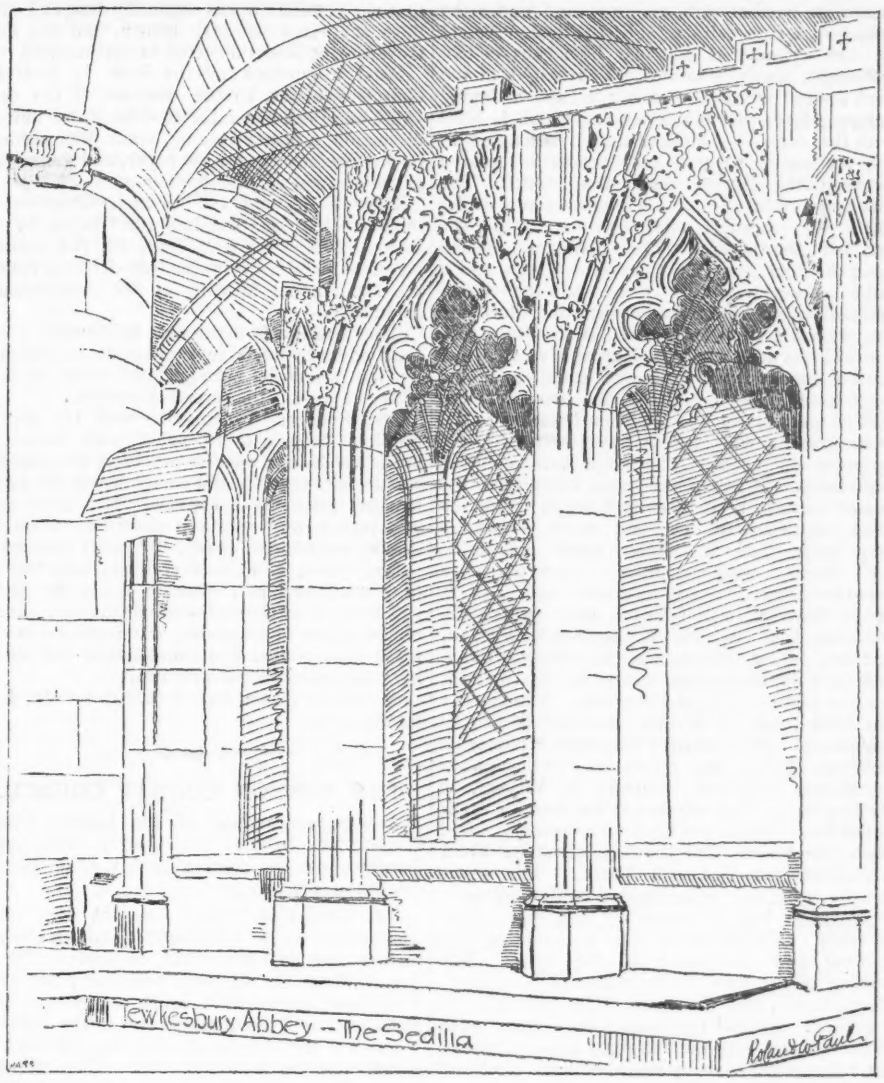
It was, however, during the third period of its history that the Abbey church underwent the most considerable changes. For the hundred years between 1314 and 1414 the manor was held by the Despencers; Eleanor de Clare, to whom the manor of Tewkesbury and the honor of Gloucester came, having married Hugh le Despencer the Younger, created by Edward II. Earl of Gloucester. With the exception of the Norman columns of the presbytery and apse, and a portion of the outer walls with their responds, the whole of the Norman work was removed, and replaced by an elaborate Decorated Presbytery of great beauty. The Norman circular columns were raised about 3 ft. and richly-moulded arches placed upon them, carrying a clearstory with triforium gallery passing below the window-cills, and through the walls at the angles. Each window was of five lights, that facing east having a wheel in the head, and all were filled with glass of the period. Rich sedilia were placed in the canted bay of the apse, on the south side of the altar, and stone screens divided the ambulatory from the series of five semi-octagonal chapels which were thrown out from it. Eastward projected a Lady Chapel, now unfortunately destroyed, and a chapel, dedicated to St. James, was built on the site of the Norman chapel, eastward of the north transept; the south wall of the Early English chapel, already described, was pulled down, and a Decorated arch put in its place, thereby throwing it into the later work. The presbytery was vaulted, and also the nave and transepts.

The Perpendicular period is represented by the remains of the cloisters, the doorway to them from the nave, two or three of the monuments and chantries, and the tracery of the great west window. Additions of a still later period include the angle buttresses north-west and south-west of the transept, the west doorway and flying buttresses on the north side of the nave at

* The series of the "Abbeys of Great Britain" is continued this month with illustrations of (No. VII.) "Tewkesbury." Particulars of this and of the three Cathedral series ("England and Wales," "Scotland," and "Ireland") will be found on p. i.; also of the forthcoming re-issue, in book form, of the series of English and Welsh Cathedrals.

† Rev. T. H. Blunt, "Tewkesbury Abbey and its Associations."

‡ See *Builder*, December 5, 1891.



the north-east angle of the Early English chapel, and at the eastern angles of the clearstory of the choir.

Between 1875 and 1879 the building underwent a thorough restoration by the late Sir G. G. Scott, and from that time to the present sundry additions have been made. The most noticeable are the pavement and steps of the sanctuary, the modern stalls (with the old Decorated backs incorporated), a pulpit on the north side of the nave, the font (the stem of Decorated date reused) raised on four steps, placed opposite the north porch against the south arcade, and the wooden screen quite recently erected between the western tower piers from designs by Mr. J. Oldrid Scott.

The ground-plan given in the present issue has been brought up to date, and shows the present arrangement of the fittings, and the Early English arch opened in the north wall of the transept.

In addition to the general character and the gradual growth of the building already described, the following points may be noted. *The nave.*—The west front, a well-known one from its fine Norman arch of seven orders (six of which project clear of the Perpendicular wall inserted), is flanked by Norman turrets rising two stages above the roof, and crowned with small spires circular on plan (an illustration of this front, from a drawing by the Editor, was published in the *Builder* of Jan. 3, 1885). The aisle windows are like the others in the nave insertions of Decorated date. Against the south wall are traces of the walls of the "outer parlour," and a doorway, now blocked up, which led to it from the south aisle. A portion of a Norman return wall still exists, showing that the Perpendicular cloister was the same as that of the Norman church. The cloisters themselves were of very rich Perpendicular work, with elaborate vaulting, as at Gloucester Cathedral. One of the jambs of the Norman cloister door remains inside, just west of the Perpendicular one (this is shown in a view published in the *Builder*, December 18, 1886, which also includes the monument eastward, known as that of the Duke of Somerset). In the nave the chief points are the late arch inserted in the westernmost bay of the north arcade, a recess (perhaps for a stoup) in the west face of the column opposite the north porch, and the traces of the rood-loft and frescoes on the second columns westward of the crossing. At the east end of the north aisle is a tomb ascribed to Lord Wenlock, but considered by Mr. Hartshorne, from a study of the costume, to be that of Sir John de Lugtburg. On the south side are the "Somerset" tomb and cloister doorway already noticed.

Both transepts are very plain Norman, with later Decorated vaulting. In the north transept is the fine Early English doorway which led to the chapel on the north, and in the south transept is a Perpendicular recess in the west wall, and the apsidal Norman chapel on the east side, now used for morning services.

The stalls are arranged under the tower. In the centre of the floor is a brass plate marking the supposed site of the grave of Prince Edward of Wales, killed in 1471. The backs of the stalls, which are twenty-four in number, twelve on each side, are ancient, of Late Decorated date.

Set between the columns of the presbytery is a fine series of chantries. In the western bay, on the north side, is the well-known "Warwick" chantry, erected by Countess Isabel Despencer in memory of her first husband, Richard Beauchamp, killed in France, 1421. It is of elaborate Late Perpendicular work, full of delicate detail, the western portion divided into two storeys, the lower one supported on slender shafts carrying an elaborate fan-vault. Between the sills and plinth are angels holding shields, now defaced.

In the next bay is the "Founders' Chapel," so called from the remains of Robert FitzHamon having been interred here, and the shrine built over them by Abbot Parker, in 1397. Before this the body lay buried in the Chapter House.

Next in order is the tomb of Sir Hugh Despencer and his wife, Elizabeth Montacute, who afterwards married Sir Guy de Bryan. His monument stands opposite, at the entrance to the Chapel of St. Margaret. Both these monuments have elaborate canopies.

On the south side the western bay is occupied by a screen. In the next bay is the Chapel of the Holy Trinity, erected to the memory of Sir Edward Despencer, K.G., by his wife, Lady Elizabeth. A curious kneeling effigy of the deceased surmounts the chantry.

The ambulatory is interesting from the fact that a good deal of the Norman walling has been left. Two responds remain on the north and one on the south. Between it and the Chapel of St. James is a portion of one of the stone Decorated screens, already alluded to, with delicate tracery in low relief, and the arms of the Despencer introduced, and the upper part of open reticulated tracery. Another screen of the same date separates the ambulatory from St. Margaret's Chapel, and the curious monument (later in date, however), of Abbot Wakeman, with its cadaver, was once undoubtedly furnished with a screen also. In the chapel between that of St. Faith and the vestry is the monument of Abbot Cheltenham, much mutilated. West of this is a fine Decorated tomb* without inscription, however. Further west are two earlier monuments, that of Abbot Allan being of the thirteenth century.

There are two recessed tombs behind the sedilia, one of which is attributed to Abbot John Cotes.

The vaulting of the whole of this part of the church is particularly beautiful, and the carved bosses are rich in figure-subjects. A large number of recesses remain in the walls of the chapels. One or two are obviously piscinæ, others are aumbreys. They are shown on the plan.

The destroyed Lady Chapel communicated with the church by a fine moulded arch. This, however, has been blocked up, and a modern window pierces the wall.

Throughout the building is a good deal of colour decoration. A diaper pattern appears at the back of the sedilia, several of the monuments retain their colouring to a large extent, and there are traces of fresco on the west face of the nave columns at the rood-screen. Besides this is the beautiful fourteenth-century glass still remaining in the clearstory windows of the presbytery.

A little distance west of the church is the "Abbey House," now part of the rectory, an elegant fragment of Perpendicular work.

Still further west is the gatehouse, also of Perpendicular date.

One of the most striking views of the church is from the private garden on the east side. An illustration of this was given in the *Builder* of January 29, 1887.

REREDOS, ST. NICHOLAS, BLUNDELLSANDS.

THE triptych illustrated was given by Sir William Forwood in memory of his daughter.

It was designed to form part of a composition in connexion with three large windows of the apse, two of which have been executed by Messrs. Powell, of Whitefriars.

The work was carried out (in oak) by Messrs. Norbury & Paterson, of Liverpool, from the design of the architect, Mr. W. D. Caröe.

PULPIT, ST. PAUL'S CHURCH, GREAT PORTLAND-STREET.

THIS pulpit was completed and dedicated in 1892, the cost of the work being defrayed by members of the congregation. It is of hexagonal form, and one side being occupied by the entrance, there remain five solid sides, each of which displays between the pilasters an intarsia panel with a cartouche bearing one of the five sacred names, the initials of which make the word IXΘΥΣ. This symbolism is further borne out by the dolphins, which form part of the intarsia decoration. The work generally is of oak fumigated and brought to a dull polish; the inlaid panels are of walnut and box, with a slip of ebony in the frame.

The design is by Mr. Paul Waterhouse, A.R.I.B.A. (A. Waterhouse & Son), and the whole of the construction was carried out by Messrs. Shuffrey & Co., of Welbeck-street.

WINDOW, OLDBURY CHURCH, SALOP.

THE illustration is from the design exhibited in the last Royal Academy. The window is one of a series which fills the church. The treatment is exceedingly light, the whole subject being almost entirely composed of various tints of white glass, with here and there a spot of colour, giving an effect of peculiar delicacy. The work has been designed and executed by Mr. Alfred O. Hemming, of London.

DESIGN FOR STAINED GLASS.

THE design for stained glass of which we give an illustration this week is by Mr. P. H. Newman,

* See *Builder*, December 18, 1886.

and was his only contribution to the Royal Academy Exhibition this year. Conceived in a Late Mediæval spirit, it is treated in *grisaille*, enriched with golden tones, colour being sparingly introduced into a simple border. The figures of Adam and Eve relieve in delicate flesh tints and stain from the cold grey of the Tree of Knowledge, in which they, with the serpent, appear to be enmeshed. The surrounding tabernacle work, with the weeping angels, is of a warmer tone of white, a gradation to the fuller colour of the border.

The design was intended for a library window, the legend of the Tree of Knowledge (with the tree springing from a human head) constituting, we presume, a kind of symbolical warning against the abuse of book-learning.

ASSOCIATION OF MUNICIPAL ENGINEERS AT MIDDLESBROUGH.

THE Association of Municipal and County Engineers held a Northern Counties district meeting at Middlesbrough on the 22nd ult. Mr. A. M. Fowler, C.E., of Manchester, presided, and there was a large attendance of North Country members.

The sad death of Mr. E. D. Latham, Borough Surveyor of Middlesbrough, on the eve of the meeting, exercised a depressing influence upon the proceedings, but the whole of the arrangements having been completed, and the members arriving in Middlesbrough before the news was generally known, made it impossible to postpone the meeting to a more opportune occasion.

The President having taken the chair, expressed deep regret at the deplorable circumstances under which they had met together. He moved "that the Association wish to convey their deepest sympathy to Mrs. Latham and family in their great bereavement in the loss of Mr. E. D. Latham, Borough Engineer of Middlesbrough, who was a Member of this Association."

Mr. T. W. Stainthorpe, Eston, who seconded, remarked that Mr. Latham was an eminent man in his profession, and belonged to an eminent engineering family.

The vote of condolence was adopted with unanimity.

On the motion of Mr. Thorrold, of North Ormeston, Mr. Howcroft, of Redcar, was unanimously re-elected Hon. Secretary for the Northern Counties district.

Mr. T. W. Stainthorpe, Surveyor to the Eston Local Board, read a paper descriptive of the floating hospital belonging to the Tees Port Sanitary Authority. He said the Authority was constituted by the Local Government Board in January, 1886, and consisted of 17 members selected from the following Riparian Authorities, viz.:—Middlesbrough, 7; Stockton, 3; Eston, 2; Thornaby, 2; Stockton (Rural), 2; and Normanby, 1. The special function of the Authority is to inspect every ship which comes into the Tees, and to see that all sanitary defects are promptly remedied, as well as to deal with all cases of infectious disease which may be found among the crews. The number of seamen entering the river is 60,000 a year. From the time the authority was constituted until the autumn of 1892 the only provision they possessed was the hulk of an old brig, with six beds, moored in the river near Newport; and since then eight cottages at Seaton Snook had been used as a temporary hospital. Upon the advice of Dr. Malcolmson the Port Sanitary Authority decided to provide a suitable hospital for the River Tees, and Mr. W. G. Laws, City Engineer of Newcastle-on-Tyne, was called in as Engineer. Mr. Laws advised the erection of a floating hospital, moored on the north side of the river, about half-a-mile below Eston Jetty, and the recommendation was accepted by the Authority, and the contract given to Messrs. Head, Wrightson & Co., of Thornaby-on-Tees. The berth was dredged from the sides, and a crescent-shaped breakwater constructed of slag to protect the hospital from the fierce gales which occasionally blow from the north and north-east. The float, on which the hospital buildings have been erected, consists of ten cylinders 86 ft. 6 in. long by 6 ft. in diameter. The plates are of $\frac{3}{8}$ in. wrought iron of the best ship quality, jointed and single rivetted, with $\frac{3}{4}$-in. rivets, $2\frac{1}{2}$-in. pitch and caulked, so as to be perfectly watertight. No. 9 rolled steel girders, each $140\frac{1}{2}$ ft. long by 12 in. deep, connect the cylinders being fixed on curved saddles which rest upon and are rivetted thereto. The cylinders are fixed 14 ft. 6 in. from centre to centre. To ensure perfect rigidity of the float three large beams are fixed at right-angles to and under the cylinders, for the full length of the float. Access to each cylinder is obtained by means of two watertight manhole covers. The height of the deck above the water-level is 4 ft., and a sloping gangway leads to a broad landing which is level with the deck of the steam-launch belonging to the Authority, so that easy access is secured between the launch and the deck. The moorings consist of wrought-iron cables fixed to heavy piles driven into the bed of the river. The buildings erected upon the float consist of two ward blocks and a large administrative midway between them. Immediately behind the administrative block are the laundry, mortuary, and destructor. The ward-blocks are each 68 ft. long and 24 ft. wide. No. 1 block consists of one small and one large ward. The former contains two beds, and will be used as the receiving or isolation ward, where patients will be kept until their cases are properly diagnosed. The large ward contains eight beds. Between the wards are placed the nurses' room and the bath-room. No. 2 block consists of a small ward containing four beds, and a larger ward containing six beds, with similar accommodation for nurses, &c. The Administrative block, 58 ft. by 30 ft., consists of matron's room (which will also be used as the dining-room), kitchen, scullery, larder, stores, medical officers' room, and four double-bedded rooms for the matron, day and night nurses, and servants. The laundry has been fitted by Messrs. Bradford & Co., of Salford; and the destructor for destroying infected bedding, clothes, and refuse has been supplied by Messrs. Goddard, Massey, & Warner, of Nottingham. The whole of the interior walls in the ward blocks are lined with $\frac{1}{2}$-in. V-jointed pitch-pine boards, and the Administrative block with V-jointed Redwood boards. The whole of the windows are provided with shutters—a provision insisted upon by the Tees Conservancy Commissioners on account of the lighting and navigation of the river. The heating of the wards is by means of Musgrave's Ulster stoves, and the temperature can be easily regulated. Special precautions have been taken to prevent fire from the flue-pipes passing through the ceilings and roofs by means of light steel and cast-iron saddles. The fresh water supply is obtained from a 300 gallon cistern fixed in the roof of each block. It is proposed to convey the fresh water down the river in a proper water-boat, and pump it therefrom into the cisterns. Great care has been taken to secure thorough ventilation in the wards. This is secured by means of double-hung sashes, the upper portion of the window being fitted with a swing-sash opening inwards. Immediately under the head of each bed, and level with the floor, is fixed one of Kite's fresh air inlet ventilators. The vitiated air is removed by ventilating shafts carried through the roof. The total cubical area in the wards is 38,246 ft., and the superficial area 2,574 ft. This gives an average of 1,912 cubical feet, and 128 superficial feet per patient, which is slightly less than the Local Government Board's requirements for fever hospitals built on land. The total cost of the hospital has been 10,000*l.*, of which 3,000*l.* is cost of dredging for berth and 7,000*l.* erection of float and buildings. Mr. Stainthorpe acted jointly with Mr. Laws as Engineer to the Authority, and also as resident engineer during the construction of the hospital.

The members were entertained to luncheon at the Wellington Hotel by Mr. Laws, and subsequently proceeded on board the steam-launch *Osprey* to the Floating Hospital, which was inspected, and the various details explained by Mr. Laws and Mr. Stainthorpe, the joint engineers. Upon the conclusion of the inspection the paper was discussed in the large ward of No. 1 block.

Dr. Malcolmson, Medical Officer of Health, Middlesbrough, said he believed the whole Tees district was indebted to Mr. Laws and Mr. Stainthorpe for providing one of the best hospitals in the Kingdom. In fact, he did not believe there was another port hospital like that in the world. The hospital had cost a great deal of money, but it was well expended if it secured them against the importation of disease.

The President congratulated Mr. Laws and Mr. Stainthorpe upon the very admirable structure they had erected.

Mr. Brown, West Hartlepool, criticised various details in the construction, more particularly as to the ventilation of the wards immediately under the beds of the patients.

Mr. Laws explained that in the ventilation of the wards they had tried to meet the wishes of the medical officer; and Mr. Stainthorpe said that the ventilation was originally designed on the lines suggested by Mr. Brown, but the Local Government Board objected to that method.

After a question by the Rev. J. J. Nolan, Grangetown, as to the disposal of the dead, which the President ruled as outside the limits of discussion, a hearty vote of thanks was accorded to Mr. Stainthorpe for his paper, and was suitably acknowledged by that gentleman.

Prior to leaving the Council Chamber the members discussed the important paper by Mr. Laws, of Newcastle-on-Tyne, on the methods adopted for sterilising cholera dejecta, read at the last Annual Meeting of the Association in London.

The President expressed satisfaction at the great advance made in sanitation, as evidenced by the scientific arrangements made at Newcastle to prevent the spread of cholera.

Mr. Spencer, Tynemouth, said the greatest problem they had to solve with respect to infectious disease was the provision of something simple, inexpensive, and temporary in its nature, to meet recurring epidemics. Mr. Laws' paper was important because it described a method simple, convenient, cheap, and easily handled.

Mr. Laws, Newcastle-on-Tyne, said the cost of a sterilising pot, charged ready for action, was 30*l.* The time of closing the lid, turning on the steam, and ejecting the sterilised sewage was not more than five minutes, and the pot was left quite clean for the next charge.

A vote of thanks was accorded to Mr. Laws for his paper.

THE LONDON COUNTY COUNCIL.

A SPECIAL meeting of the London County Council was held at the County Hall, Spring Gardens, on the 23rd ult., Sir John Hutton, Chairman, presiding.

The Council as Contractors.—A long report was submitted by the Works Committee, giving further accounts for works as audited by the comptroller. In all there were thirty-two works mentioned, seventeen of which have already been reported on. The estimated cost of the seventeen works was stated to be 27,286*l.* 14s. 1d., and the actual cost 24,965*l.* 13s. 11d. The estimated cost of the whole of the works was stated to be 66,061*l.* 19s. 2d., and the actual cost 63,045*l.* 18s. 5d. In a few cases the figures had not been completely examined by the comptroller, but he had reported that they were not likely to be materially altered. The most important work was that of the New Cross Fire Brigade Station, where the estimated cost was 15,801*l.* 16s. 7d., and the actual cost 18,785*l.* 8s. 8d. On the other hand, the cost of the Hackney to Holloway main relief sewer was put at 8,050*l.* 14s. 8d., against an estimated cost of 12,672*l.* 12s. 5d. The report stated that the works in which the actual cost was below the estimated cost required but little comment. Where the quality of the work did not enter into consideration, or when it could not vary much, such as the excavation, brickwork, &c., in a sewer, the cost of the work compared most favourably with the cost of that undertaken by a contractor. On the other hand, in architectural work, where the cost had exceeded the estimate, the Committee claimed for their work a quality which was only comparable with that executed by builders of the highest class, who rarely, if ever, undertook work at competitive prices. Their manager stated that in his estimates he assumed the work required would be of the ordinary quality, whereas the highest class had been demanded from him. As they had no stock of seasoned timber they had to purchase at a high price. For some time until they could erect machinery their joinery was made by hand. A number of foremen were engaged with high-class testimonials; a few of them had been unsatisfactory, and though they had been discharged they had naturally suffered through having no tried staff with which to commence. A number of instances had arisen where a contractor no doubt would have made large extra claims; but, of course, no such question could arise between committees of the Council. At New Cross Fire Brigade Station they were delayed nearly three months waiting for drawings of the ironwork, with the result that part of the brickwork was carried up piecemeal, and the rest had to be executed in the winter instead of in the summer. Their manager estimated that a loss of over 500*l.* had occurred that way.

Mr. Westacott moved as an amendment that the report be not received.

Mr. Remnant seconded the amendment.

Mr. Thornton opened the debate, and in the course of his remarks he admitted that the Committee had not done all they expected, but they had had to contend against enormous difficulties, and, all things considered, the Committee had done very well.

Lieutenant-Colonel Ford denied that there was any desire on the part of the Moderate Party to smash the Works Committee, as had been alleged, but they did desire information. He thought that the date should be given when a work was commenced and when it was finished, for that was a material point.

Mr. Lloyd, who defended the Committee, said he thought that a sum, say 100,000*l.*, should be put to the credit of the Committee, and that they should be allowed to work on it.

Mr. John Burns, M.P., in the course of a long defence of the Committee, said the estimated cost of the work was 66,142*l.*, and the actual cost 63,045*l.*, a saving of 3,000*l.* and yet at the end of the year the policy of the Committee was said not to be a success, although there had been a saving of 4 per cent. all round under all the difficulties which had surrounded them. There had not been a single complaint of the work; if anything it was done too well. Their men refused to "scamp" work. He admitted that the Works Committee would never be able to make much profit, and if the architect subjected it to petty restrictions it would be a failure. They paid trade union wages, and the work was done better than it used to be. They were harassed by the demands of the architect's department ostensibly for information.

Mr. Beachcroft rose to a point of order, and said if the architect was to be attacked he should think he should be present.

The Chairman said he did not recognise it as an attack.

Mr. Burns proceeded to deal with the report of the Parks and Open Spaces Committee.* He said that the day of the middleman was over; and if they wanted good work they must have direct labour. That they had employed, and if there had been a loss of 4 per cent. on every job instead of a gain, it would be justifiable in the face of the high wages they had paid and the good work done.

Mr. Beachcroft said that those who represented the Works Committee felt extremely uncomfortable if anything in the way of criticism was levelled at them. Mr. Burns had stated that a contractor would be pleased to get a profit of 4 per cent., but he doubted that statement, for looking at the risks they ran he thought that 10 to 15 per cent. was more what they looked for. The Council expected the Works Committee to get a profit of 5 per cent. on the works, but from facts he had in his mind he feared the result would be different. As a member of the Housing Committee he could not say there had been a saving in the work done for that Committee. He thought if they could not do better they should give it up.

Messrs. Arthur Arnold, Cohen, M.P., Lemon, and H. Ward (chairman of the Committee), having spoken, the amendment was put and declared lost.

Mr. Lemon then moved that the following words be added to the recommendation:—"And also provide that in carrying out any work the Works Committee shall not be at liberty to exceed the estimated amount of the cost except after a vote of the Council taken upon a recommendation submitted by the Committee for which the work is being carried out approving the additional expenditure." He thought that if business was to proceed on safe lines an account should be kept of how they were going on. The present unsatisfactory way of doing business ought to be altered, and he asked them to carry his recommendation.

Mr. Campbell seconded the amendment.

Mr. Ward said that if the mover and seconder were practical men they would not have moved the amendment. It was impossible to stop a work three-fourths finished and say how much it cost.

Colonel Rotton said that in the Fire Brigade Committee from April 1, 1891, to March 31, 1892, the estimate for small jobs was 2,751*l.*, and the actual amount paid was 2,672*l.* In that year the work was done by contractors. From April 1, 1892, to March 31, 1893, the estimated cost for small jobs was 6,262*l.*, and the actual amount paid 6,897*l.* In that year part was done by contractors and part by the Works Committee. From April 1, 1893, to March 31, 1894, the estimate for jobbing work was 6,172*l.*, and the actual cost 9,758*l.* In that year the whole of the work was done by the Works Committee. If any member had any charge to make against the architect or other officers, they should have the courage to put them in plain language.

Mr. Antrobus opposed the amendment, as he thought it was not practicable.

The amendment was lost by a large majority.

Mr. Westacott then moved that the following words be added:—"And also provide that each Committee, on whose recommendation any work shall be given to the Works Committee, shall, in the event of the estimate being exceeded, report the same to the Council, with particulars of the amount by which it has been exceeded, and the reason thereof, so that the Council may have the whole facts before them."

This was seconded by Mr. Fletcher, and lost.

Mr. Beachcroft said that he had intended to move an amendment on the discussion of the Parks Committee Report, but as it applied to the Works Committee it would be as well to move it now. He would move:—"That in view of the facts stated in the Report of the Parks and Open Spaces Committee it is desirable a profit and loss account on works executed by the Works Committee should be forthwith established by the Council, fed when occasion requires out of the Consolidated Fund, and that it be referred to the Finance Committee to consider and report as to the establishment of such an account."

Mr. Fardell, in seconding the amendment, said he could see no valid objection to it.

After further discussion the amendment was lost, and the recommendation of the Committee was agreed to.

The adjourned Report of the Parks and Open Spaces Committee regarding the excessive cost of works undertaken by the Works Committee was brought up. It was given *in extenso* in our issue of the 17th ult. The recommendation of the Committee was agreed to.

York Water-gate.—The Parks Committee reported:—

"The Council will remember that under the London Open Spaces Act, 1893, the York Watergate and the strip of land bounding the Victoria-embankment Gardens to the north of the gate were transferred to the Council. We have carefully considered the question of dealing with this piece of land and the gate itself, having due regard to the desirableness of retaining so far as possible the gate in its present position, and at the same time making the interesting structure not altogether purposeless. The scheme which we now recommend to the Council for adoption provides for new entrances being formed to the gardens from Buckingham-street and York Building, the entrance in the latter case being through the water-gate. To enable this to be done with the gate at its present level, steps would have to be made leading to the gardens from the street. The approach to the gate from the gardens would be by two flights of stone steps meeting before the gate. This arrangement of stone steps and retaining walls will add considerably to the effect of the gate by breaking up the area of grass in the foreground. The strip of land now outside the gardens will be planted with trees and shrubs, so as to take off the bare appearance of the wall on the north side. A sum of 500*l.* is included in the estimates for the work, and the Finance Committee have arranged for the payment of the balance out of the contingency fund."

The Committee concluded their report with a recommendation that they be authorised to expend 650*l.* dealing with the York Water-gate. The recommendation was agreed to without debate.

Regulations under the London Building Act, 1894.—The adjourned report of the Building Act Committee consisted of a number of regulations and standing orders having reference to applications for sanction or consent under the various Metropolitan Building and Management Acts which had been made over again with particular reference to the new Act.

Notice had been given by Mr. Goodman of the following amendment on recommendation (*b*), (Part IX.—Dangerous and Neglected Structures):—"That the following be inserted after Clause 2—'In the event of the District Surveyor finding that in his opinion the structure is not in a dangerous state, and if it appear to him that the complaint relates to a question of repair only, he is to state that fact in his certificate.'"

The amendment, however, was lost, after a brief discussion, and the report was adopted.

The usual weekly meeting of the Council was held on Tuesday.

Appointment of a River Committee.—On the recommendation of the General Purposes Committee, it was resolved that a standing committee should be appointed to deal with all questions connected with the conservancy of the rivers Thames and Lea, and that it should consist of the six representatives of the Council on the Thames Conservancy Board, the representatives of the Council on the Lea Conservancy Board, and five other members.

Tumulus at Parliament Hill.—Amongst the subjects dealt with in the report of the Parks and Open Spaces Committee was that of the recent exploration of the barrow on Parliament Hill, popularly known as "Boadicea's Tomb." The conclusions which Mr. C. H. Read, F.S.A., of the British Museum, who superintended the opening of the tumulus, arrived at were:—"(*a*) That it is without question an artificial mound, raised at a spot where there was originally a slight rise in the ground. (*b*) That a great quantity of additional material was added to it, chiefly on the northern and eastern sides, and probably within the last two centuries. (*c*) That the tumulus has not been opened before. (*d*) That it is very probably an ancient British burial-mound of the early bronze period, and, therefore, centuries before the Christian era. The burial was probably by inhumation, and the bones have entirely disappeared, a circumstance by no means uncommon. In this interpretation of the evidence his opinion is supported by that of Canon Greenwell, whose lengthened experience of these burials enables him to speak with an authority beyond question upon this point." It was agreed that a vote of thanks be accorded Mr. Read.

The Council adjourned at a quarter to eight.

ARCHITECTURAL SOCIETIES.

LEEDS ARCHITECTURAL SOCIETY.—At the second ordinary meeting of the Leeds and Yorkshire Architectural Society, held on the 26th ult. at the Leeds Mechanics' Institute, a paper, by Sir George Chubb, on the "History and Development of Locks and Safes," was read by Mr. H. W. Chubb. The ornamentation of locks and keys, he remarked, had never been erratic. It had altered in exact accordance with the ornamentation of the periods of art. Whenever architecture, the parent of the constructive arts, had changed its character for better or worse, it had elevated or depressed the character of its subsidiary arts, and the little metal keys and locks took their share in the change. He proceeded to describe modern keys and locks, illustrating his remarks by a number of interesting diagrams and models. One point of interest in modern safes and strong-rooms had reference to the heat and fire-resisting materials used in their construction. Any such material must in itself be incombustible as well as a non-conductor. Nothing, however, was perfectly proof against fire or thieves, the degree of protection depending upon the sum of money expended. Of strong-rooms and safes the lecturer exhibited several models. The chair was occupied by Mr. C. T. Dodgshun, the President of the Society.

CARLISLE ARCHITECTURAL, ENGINEERING, AND SURVEYING ASSOCIATION.—A meeting of this Association was held on the 21st ult. in the Town Hall, Carlisle, when a lecture was delivered by Mr. F. J. Nickols, Chief Assistant in the City Surveyor's Office, on "The Housing of the Working Classes," Mr. Claude Lonsdale, the President, being in the chair. Mr. Nickols commenced by defining "working classes" for the purpose of his paper as that class in receipt of from 18s. to 24s. weekly, and by detailing the law on the subject, in this connexion referring to the important powers granted by the 1890 Act when adopted by an authority. He then gave short descriptions of the buildings erected in London, Liverpool, and Leeds, with details of cost and rental. He drew comparisons between the respective merits of back-to-back houses, barrack-dwellings, and self-contained houses, pointing out the various advantages and disadvantages incurred by the adoption of each class, and gave as a conclusion that the self-contained house, where possible, with through ventilation, was by far the best form. A discussion followed, some favouring the flat system with an outside staircase, and condemning the back-to-back houses on account of inefficient ventilation and structural inconveniences. It was pointed out that a comparison could scarcely be drawn between barrack-dwellings and back-to-back houses, and that in any case self-contained houses, where possible, are much to be preferred.

GLASGOW INSTITUTE OF ARCHITECTS.—At an ordinary meeting of the Council of this Institute, held on the 26th ult. within the chambers of the Secretary, Mr. C. J. MacLean, 115, St.

* See the *Builder* for Nov. 17, page 356.

Vincent-street, it was reported on behalf of the committee appointed at last meeting to look into the method being adopted in connexion with the restoration of Glasgow Cathedral, that a representation had been sent to H.M. Master of Works and a reply received from him entirely concurring in the views of the committee. The report was considered satisfactory, but the committee were continued in office in order that they might observe the operations as they proceed. An overture from the Glasgow Architectural Association as to the joint occupancy of premises with the Institute was submitted. It was favourably considered by the members present, and a committee was appointed to meet with a similar committee of the Association.

Correspondence.

To the Editor of THE BUILDER.

STRENGTH OF ARCHED IRON RIBS.

SIR,—Referring to the article in the *Builder* on the above, I notice that in calculating the "safe moment of resistance," the thickness of the metal "t" is taken as uniform throughout the section of rib. Now, as this rib increases in depth from the crown to the springing, it cannot be a rolled I section, but must be built of a web plate and angle-iron flanges. Would it not therefore be better to calculate the section of the rib in a similar manner to a plate girder, viz., by neglecting the web and taking the stress as acting on the flanges only?

Then, taking Example III.

f being the safe stress per square inch in cwts.,

$$\text{area of the flange} = \frac{M}{fD} = \frac{11395}{100 \times 16{\cdot}5} = 6{\cdot}9 \text{ sq. in.}$$

The section of rib could then be formed of No. 2 angles 4 in. by 4 in. by $\frac{1}{2}$ in., and web $\frac{5}{16}$ thick. This would make a neater rib, and would effect a considerable saving in weight. Hoping that you may see your way to publish similar articles bearing on practical methods of calculation, as no doubt they would be much appreciated by your readers.

J. D. WYATT.

*** In the article referred to the ribs are taken as built up with top and bottom plates rivetted to the web by light angle-irons (the resistance of the angle-irons is not taken into account). The *moment of resistance* is equal to the *moment of inertia* of the section divided by half its depth and multiplied by the stress (five tons) per square inch. If the web (Ex. 3) were only $\frac{3}{8}$ in. thick it would be liable to crumple under the strain, and the flanges being held only by one set of rivets would not be so strong as when rivetted to top and bottom plates as well as to the web. The saving of weight would not be worth considering when compared with the reduction in stiffness.—THE WRITER OF THE ARTICLE.

A WARNING.

SIR,—My house has just had a narrow escape from fire, as follows.

A very short stiff gas-bracket, with naked burner, was supplied by a composition pipe. The pipe was led down to the bracket from the ceiling, not up to it from the floor.

During a quarter of a century to my knowledge, and possibly for twice that time, the bracket behaved well enough; but last Sunday the flame from it managed to fuse the composition pipe. Probably some unwonted current of air, or may be some corrosion of the nipple, caused the jet to come in contact with the tubing (about 6 in. away), and a big flame spurted out, speedily charring the wood panelling of the wall.

Luckily it was seen in good time, but I feel that I have had a narrow escape, and venture to give my experience for the benefit of others. L. C. R.

BALL-ROOM FLOORS.

SIR,—Would any of your numero kindly inform me where I could obtain any information about the construction of *ball-room floors*—the object, of course, being to get the greatest amount of springiness consistent with strength? I believe they are sometimes hung on chains.

A.R.I.B.A.

The Student's Column.

DETAILS OF RURAL WATER SUPPLY.—XXII.

STORAGE OF RAIN-WATER.

As the rainfall is stored on a large scale by impounding reservoirs for the purposes of providing a supply or water for domestic and other purposes, to towns or a series of villages, so also it may be collected and stored on a small scale for the use of isolated dwellings. In the latter case, roofs or prepared areas of ground take the place of the catchment area; the impounding reservoir is replaced by metal, masonry, brickwork, or concrete tanks, which also constitute the service-tanks; and filter-beds of adequate dimensions have also to be provided. Storm overflow must not be omitted, but in this case with the sole object of preserving the purity of the water in the tank. The principles involved in the necessary calculations are likewise similar, the supply depending upon the available rainfall and the area of the collecting surfaces.

Rain-water from the roofs of houses is usually collected by means of gutters, with the immediate object of preventing it from flowing down the walls and rendering them damp. It is also usually stored in butts or tanks for washing purposes, when the principal supply is of a hard nature, and for other purposes when the latter is limited in quantity. It is rarely, however, employed for dietetic purposes except as a last resource, when no other supply is forthcoming. In fact, the prejudice against it is so great that people frequently prefer to it the water of wells or springs which they know to be polluted. Another reason, perhaps, is the general ignorance of the capabilities of a comparatively small collecting surface in affording a regulated daily supply through the use of storage capacity properly proportional to the particular area of surface and the available rainfall.

As stated in Chapter IX., the amount of rainfall varies considerably in different parts of the country—from 40 to 70 in. per annum on the western coast, from 30 to 40 in. on the southern coast, and from 20 to 30 in. on the eastern coast—the average rainfall over the whole of Great Britain being about 33 in. Further, it was stated that the rainfall at the same place varied considerably in different years—from 45 per cent. above the average to 33 per cent. below the average. There is, however, another most important variation in the rainfall, when corresponding months in different years are compared, which plays a most important part in the calculation of the necessary amount of storage-capacity for roof or similarly collected supplies. In this case there is no percolation, and the rainfall passes directly into the storage-tanks, the flow not being subject to regulation by the catchment area.

An examination of the following table, taken from "Sanitary Engineering," by Baldwin Latham, M.Inst.C.E., F.G.S., will show that, although the monthly averages are fairly constant when the observations extend over several years, the individual falls vary from 204 per cent. above the average, as in December, 1876, to 90 per cent. below the average as in September, 1865:—

The theoretical storage capacity should be such that the tank should contain a sufficient quantity of water at the commencement of a drought so as to afford the calculated daily supply until it is over; also to be able to store the surplus of the rainfall above the consumption during wet weather. Or, in other words, that there shall always be a sufficient supply of water in the tank—provided that only the calculated amount is abstracted from it daily—and that the tank shall never overflow. The lowest annual rainfall must be taken as the basis upon which the daily supply is to be calculated. In the above table the lowest annual rainfall was 20·26 inches, which, if properly stored (excluding loss by evaporation) would supply a monthly consumption equal to 1·69 inches. The storage capacity necessary to equalise the rainfall in order to furnish this supply may be calculated by the method given in Chap. XIII., either graphically or arithmetically.

The calculation of storage capacity based upon the rainfall for 1864, given in the table above, is as follows;—

Month.	Rainfall.	Consumption.	Algebraical Sum.	Accelerated Sum.	A
January	1·34	1·69	− ·35	− ·35	1·25
February	1·32	1·69	− ·37	− ·72	·88
March	2·95	1·69	+1·26	+ ·54	2·14
April	·64	1·69	−1·05	− ·51	1·09
May	2·69	1·69	+1·00	+ ·49	2·09
June	·80	1·69	− ·89	− ·40	1·20
July	·99	1·69	− ·70	−1·10	·50
August	1·19	1·69	− ·50	minimum −1·60	0·00
September	3·09	1·69	+1·40	− ·20	1·40
October	1·26	1·69	− ·43	− ·63	·97
November	3·46	1·69	+1·77	maximum +1·14	2·74
December	·53	1·69	−1·16	+ ·02	1·58

To give an equalised monthly supply equivalent to 1·69 inches would, therefore, require a minimum storage capacity for 1·60 + 1·14 = 2·74 in.—provided that the tank contained at the commencement of the year a quantity of water equivalent to 1·60 in.

The column marked A in the above table shows the depth of rainfall corresponding to the quantity of the water contained in the tank at the end of each month, under these conditions. This is assuming that the rainfall is uniform throughout each month, but as this is not usually the case, and the bulk of it may fall during the first day or two, it is necessary to increase the storage by one month's consumption = 1·69 in.—making the total storage capacity equal to 4·43 in., or about 22 per cent. of the total annual rainfall. Mr. Thomas Box ("Practical Hydraulics") gives one-fourth of the total annual rainfall as the minimum storage capacity, and this may be taken as a safe rule.

There are several rules for calculating the supply of water obtainable from a given collecting surface and annual rainfall, three of which are given here:—

1. Multiply the area in square feet by half the annual rainfall in inches = the quantity of water in gallons approximately (Parkes' "Practical Hygiene").

2. Multiply the area covered by the roof in square feet by the average annual rainfall, also in feet, and divide the result by 100 = the average supply in gallons per diem for a very dry year (J. Wallace Peggs, "Transactions, Sanitary Institute," vol. xiv.).

3. Multiply the lowest recorded rainfall in feet by the collecting area in square feet by ·015 = the average number of gallons per day, including a small allowance for loss in the collection. ("Water, its Composition, &c.," by Joseph Parry, C.E.)

RAINFALL AT CROYDON, COMPILED FROM OBSERVATIONS MADE BY MR. GEO. CORDEN, CROYDON.
Rain-gauge, 154·6. O.D.—"Sanitary Engineering," 2nd Ed., by BALDWIN LATHAM, M.Inst.C.E., F.G.S., pp. 54 and 55.

Month.	Monthly Average.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.
January	2·95	·49	2·10	2·87	1·34	3·45	4·51	3·12	4·31	2·91	1·43	2·87	5·54	4·08	1·15	3·49	1·04	5·53
February	1·70	2·37	·48	·61	1·32	1·82	5·11	1·24	1·22	2·46	1·72	1·19	1·07	1·69	1·83	1·04	2·05	1·70
March	1·82	2·72	3·26	·79	2·95	1·05	2·08	2·58	1·08	1·52	1·84	1·50	2·13	1·55	·55	·65	2·57	2·15
April	1·54	·61	2·27	·61	·64	·27	2·04	1·75	1·92	1·16	·42	3·23	1·23	·63	1·87	1·74	1·67	4·10
May	1·82	·93	3·45	1·50	2·69	3·40	2·17	1·52	·76	3·20	·86	1·00	3·05	1·21	·86	·95	·93	2·38
June	1·93	1·90	3·06	3·59	·80	1·99	3·05	1·85	·35	1·34	·20	2·68	1·96	3·41	2·54	2·26	·99	·87
July	2·25	2·78	2·09	1·16	·99	3·33	1·48	4·21	2·23	·66	2·24	2·89	3·29	2·27	1·18	4·50	·34	2·58
August	2·15	·54	3·36	2·10	1·19	3·69	3·16	2·08	2·98	1·24	1·86	·81	2·24	2·53	2·41	·90	2·75	2·70
September	2·69	2·16	1·96	5·16	3·09	·27	4·07	2.57	1·71	3·32	2·44	5·00	1·63	2·30	2·49	2·90	3·07	1·65
October	2·93	1·03	4·92	2·22	1·26	7·20	1·33	1·89	2·37	1·66	4·24	1·17	5·24	3·14	4·83	4·07	1·31	1·97
November	2·53	5·41	1·37	2·08	3·46	3·14	1·38	·62	1·15	2·53	1·89	·55	3·50	2·54	2·59	3·15	2·67	4·94
December	2·44	1·29	2·02	2·88	·53	1·80	2·00	1·61	4·50	3·38	3·03	1·65	4·39	·36	1·80	1·22	7·43	1·61
Total Annual Average	26·75	22·23	30·34	25·57	20·26	31·41	32·38	25·04	24·58	25·38	22·17	24·54	35·27	25·71	24·10	26·87	26·82	32·18

The following table, by W. Sowerby Wilson, F.R.M.S., shows the daily yield of water from a roof with varying rainfall :—

AREA OF HOUSE, 10 FT. BY 20 FT., OR 200 SQUARE FEET.

Mean Rainfall.	Loss from Evaporation.	Requisite Capacity of Tank.	Mean Daily Yield of Water.	Mean Daily Yield of Water in Wettest Year.	Mean Daily Yield of Water in Driest Year.
Inches.	Per Cent.	Cubic Feet.	Gals.	Gallons.	Gallons.
20	25	100	4·3	6·7	3·2
25	20	135	5·7	7·5	3·9
30	20	145	6·8	9·4	4·5
35	20	155	7·9	11·0	5·0
40	15	165	9·7	13·1	7·2
45	15	170	10·9	14·2	8·6

For any other size of roof or amount of rainfall, the numbers will be proportional.

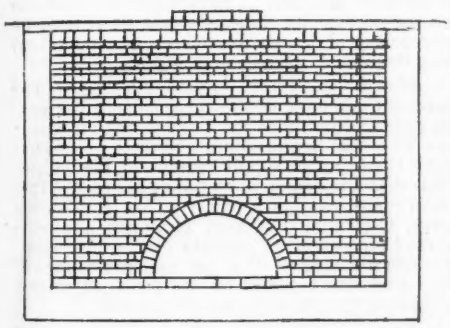
The area of roof-surface for collecting water must be measured on the flat, and not on the slope, and is the same as the area of the ground covered by the roof (if the ground be level). The average collecting area of house-roofs is about 60 square feet per individual.

Roofs of houses in town, or near factories, or in any situation where the air is liable to pollution, are not suitable for collecting water for dietetic purposes, and roofs covered with thatch, felt, lead, or zinc—the two last on account of the solvent property of rain-water—must not be used for the purpose. Lead pipes in connexion with the storage tank must also be avoided. In order to obtain a satisfactory supply of water for domestic purposes from roofs or similar areas, the greatest constant care is necessary to keep the roofs and gutters clean, and to remove all bird-excrement, &c.

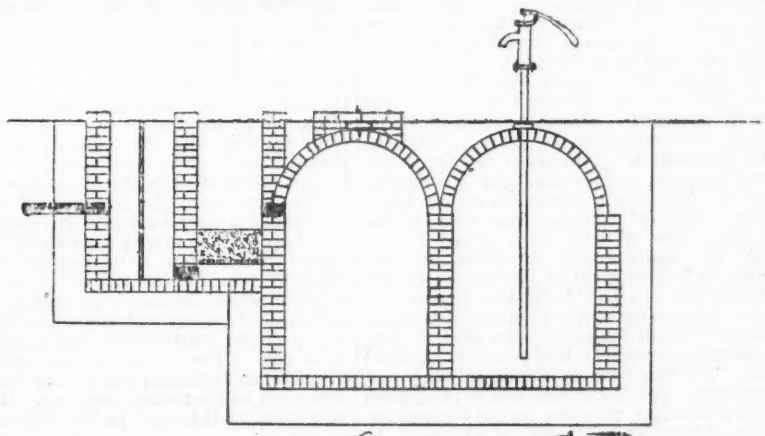
The first portion of the rainfall collected from roofs, especially after a long period of dry weather, is usually of an impure nature, on account of the soot and other matters which have had time to accumulate. In order to prevent this portion from entering the storage tank, mechanical appliances, known as "rain-water separators," have been devised. These consist of vessels into which the rainfall is directed before passing into the storage tank, and which are so constructed as to collect the first portion of the flow, and when full to cant over, emptying their contents to waste, and at the same time placing the flow of water from the roof in direct communication with the storage tank. When the flow has ceased they return automatically to their original position.

The rain-water may be stored in overground or underground cisterns, or reservoirs. The former have the advantage of enabling the water to be drawn direct by means of a tap, but are generally more expensive, and the water is subject to changes of temperature. The underground reservoir necessitates pumping, and is more liable to permit of pollution. The water should be strained through a copper strainer to keep back leaves, &c., and should be filtered before admission into the storage-tank. The filtering material may be sand, polarite, or other suitable substance. The tank should be efficiently ventilated; have a sufficient covering of earth so that the water may be kept at an equable temperature; and should be, if possible, provided with a wash-out valve for cleansing purposes. Fig. 55 is an illustration of a brick underground tank, with strainer and filter-bed, to contain 2,500 gals., designed for a small isolation hospital.

Where the roof surface is insufficient, a small area of ground may be fenced off, and either underdrained by means of agricultural tiles, or the surface may be covered with tiles or concrete, and the rain-water falling upon it taken by means of pipes to a storage-tank.



Section AB



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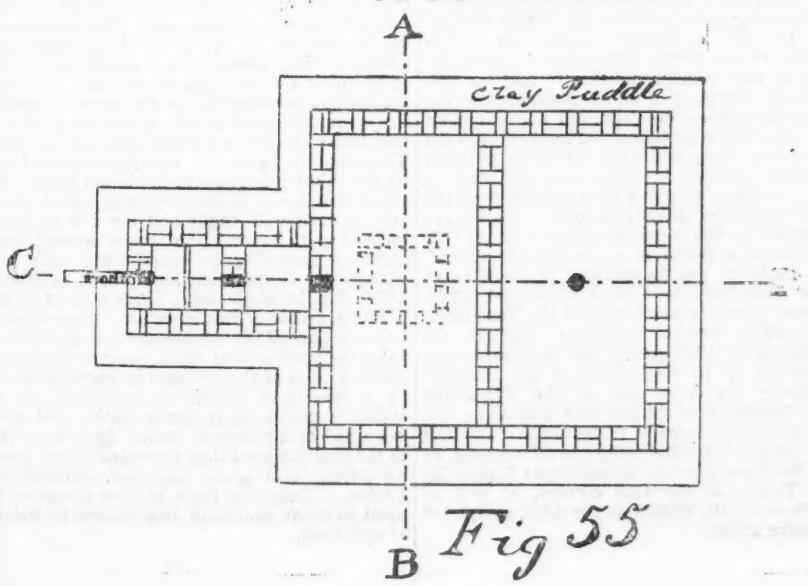

Fig 55

GENERAL BUILDING NEWS.

FREE CHURCH, MORNINGSIDE, EDINBURGH.—A new church has just been erected at Morningside, Edinburgh, from plans prepared by Mr. Hippolyte Blanc, A.R.S.A., Edinburgh. The building is situated near the Churchhill corner of Morningside-road. As specially desired by the congregation, the building is designed in a phase of the Renaissance period, with campanile tower at the south-west corner, the building of the upper stages of which it is intended to leave meanwhile in abeyance. The plan of the church is an elongated rectangle, and it comprises the church area with recessed pulpit platform and organ chamber at one end, with vestibule and staircases at the others. Behind the church is a large hall accommodating 250 persons, class-room for sixty infants, vestry, session-room, and soirée kitchen; in an upper floor there is an additional class-room and a caretaker's residence. Towards the street the main building presents a composition of two stages, the lower pierced for three doorways grouped within two massive piers of channelled ashlar work. The entrance vestibule, which is paved with ceramic tiling in geometric design, measures about 30 ft. by 20 ft.; and at either end of it are the main stairways leading to the galleries. To keep the interior as light and airy as possible, instead of heavily-projected galleries, those along each side have been projected to an extent to accommodate only a single row of sitters. They are supported upon cantilevers without any pillars, and their shallowness obviates the necessity for windows being placed under them. The back gallery is of normal depth, being extended over the entrance vestibule below. A passage of communication runs behind the sitters in the side galleries, and throughout the church there is an uninterrupted view of the pulpit secured to every sitter. Both for the area and gallery floor, heating radiators are placed in wall recesses at regular intervals. The total accommodation of the church is upwards of 800. The material used for mason work is red Corsehill stone, for the constructive woodwork red pine, and for the finishings yellow pine. The estimates came to about 9,600*l.*

COTTAGE HOMES FOR PAUPER CHILDREN, SHEFFIELD.—On the 24th ult., Sir Walter Foster, M.P., opened at Sheffield the new head-quarters and receiving house, built in connexion with the system of isolated cottage homes which have been established throughout the city. The new buildings are situated on the Goddard Hall estate, in Smilter-lane, Crabtree. The gates opened by Sir Walter Foster adjoin the lodge of the administrative block and receiving home, in which are a waiting-room for applicants and parents visiting, medical officers' and examination-rooms, with bath, sitting-rooms for the foster-parents, a kitchen, separate day-rooms for boys and girls, lavatories, baths, and store-rooms. There are separate staircases and dormitories for boys and girls, with a bedroom for the foster-parents. Iron escape-stairs are placed outside of each dormitory, while across a yard from the girls' side are placed clothes store, washhouse, laundry, and disinfecting house, with independent entrance. From the lodge corridor run stores, and on the upper floor is an office for the superintendent and a committee-room. In the same building, and over the principal stores, is the residence for the superintendent. The three detached homes which at present complete the headquarters, and which have been respectively named "Ivy Cottage," "Hawthorne Cottage," and "Rose Cottage," are to the west of the entrance, each having a piece of garden, a playground, a shed, and a washhouse. The children's hospital is on the same estate, but approached in a northerly direction from the road between the three cottages and the administrative block. This building is intended ultimately to be connected by a corridor with the administrative block of the general hospital, which will be between it and the workhouse. Mr. C. J. Innocent, Sheffield, has been the architect; Messrs. George Longden & Son, Neepsend, the contractors; and Mr. George Malpas the clerk of works.

REBUILDING OF BANK, LIVERPOOL.—Messrs. Grayson & Ould, of Liverpool, have prepared designs for the rebuilding of the head office of the Bank of Liverpool. The fireproof floors and constructional iron and steel work will be put up by Messrs. Mark Fawcett & Co., of Westminster.

HALL AND SUNDAY-SCHOOLS, WYCLIFFE CHAPEL, SHEFFIELD.—On the 26th ult. the new hall and Sunday-schools which have been erected by the church worshipping at Wycliffe Chapel, Langsett-road, Sheffield, were opened. The site of the new buildings is in Channing-street. The block comprises a lecture-hall, with galleries on three sides, and with three separate approaches from the outside. There are also a room for week evening services, a ladies' vestry, deacons' and minister's vestries, choir vestry, infants' class-room, two rooms to be used in connexion with the young people's institute or club, kitchen, an elevator to the large hall, and all the usual conveniences. In addition to these rooms there are several other class-rooms, and store-rooms and cellars. The corridors and staircases are lined with glazed bricks, and are ornamented, the whole being connected with the chapel by a long passage. The building is of brick, with Grenoside stone dressings. The contract for the

whole of the works was taken by Mr. Joel Midwood, Walkley, Sheffield. The architect is Mr. C. J. Innocent, Sheffield.

CATHOLIC CHURCH, MILES PLATTING, LANCASHIRE.—The foundation-stone of St. Edmund's Catholic Church, Miles Platting, was laid on the 24th ult. by the Rev. Dr. Bilsborrow, Bishop of Salford. The architects for the new buildings are Messrs. Pugin, of London, and the contractors Messrs. Robert Neill & Sons. The total cost is estimated at about 10,000*l.* The new church will provide accommodation for 1,100 persons. It will be divided into five bays, each 25 ft. long. In the bay at the west end the gallery will be placed, and another bay will be occupied by the chancel and side chapels. At the corner of Monsall-street and Mary-street a tower will ultimately be erected. The total length of the church internally will be 125 ft., the width 65 ft., and the apex of the roof will be 62 ft. above the level of the ground. The new church will be dedicated to St. Edmund, Archbishop of Canterbury in the thirteenth century.

RENOVATION OF HEYDON CHURCH, NORFOLK.—The Church of St. Peter and St. Paul, Heydon, has just been opened after partial restoration. The nave roof has been restored, and as much of the old timber as possible utilised in the interior work. The lead has been re-cast, and the parapets and copings repaired. Considerable attention has been paid to the renovation of the clearstory windows, which have been re-glazed, and partial restoration has been effected in the south aisle. The sacrarium is paved with encaustic tiles, decorated with the emblems of St. Peter and St. Paul, and the ancient pulpit has undergone complete renovation. The entire work was carried out under the direction of Mr. Herbert J. Green, architect, of Norwich, the general work was done by Mr. Blyth, builder, of Foulsham, and the lead-casting, re-laying, and glazing by Mr. Gibson, plumber, of Norwich.

NEW PREMISES FOR THE "HEXHAM COURANT."—New premises for the *Hexham Courant* have just been erected at Hexham. The new buildings have a frontage of 33 ft. to Beaumont-street, and cover an area of 3,300 sq. ft. The offices are situated on the ground-floor. Immediately on the right of the entrance the public office is placed. Opening out of this is the office for the manager communicating with the public space. A large strong-room is arranged to the rear for the storage of books, paper, &c. A postal despatch-room adjoins this, communicating with the offices for the folding and despatching of newspapers. The printing department occupies a large portion of the site to the rear, and covers an area of 1,636 sq. ft. The whole is covered by an open roof with top light. A covered washing-yard for washing the type and damping the paper is situated behind the printing-room, adjoining which are placed the sanitary arrangements for the use of the staff, while below the washing-yard is placed the heating-chamber, containing boiler and fuel store. A paper store is situated on the first floor to the rear. A staircase connects this store with the printing department. Over the offices at the front is arranged the compositors' room, area 780 sq. ft. On the second, or top floor, over the above room, the whole of the editorial staff has been provided with rooms. Each floor is connected with a small lift, and speaking-tubes are fixed between each department and the manager's office. The whole establishment has been warmed by means of hot water on the low-pressure circulating system. The front elevation is a Renaissance treatment. The whole of the works have been carried out from the designs and under the personal supervision of the architects, Messrs. Marshall & Dick, of Newcastle. Mr. Edward Snowball, of Hexham, obtained the whole contract.

NEW INFIRMARY, MERTHYR-TYDFIL.—The Guardians for this Union have determined on the erection of an infirmary, at a cost of 10,000*l.* Mr. E. A. Johnson, of Abergavenny, will be the architect for the new building.

SANITARY AND ENGINEERING NEWS.

SEWERAGE WORKS, SHIREHAMPTON, NEAR BRISTOL.—Colonel Luard held an inquiry at Shirehampton on the 21st ult., with respect to an application to borrow money for the purpose of sewerage for a portion of Lower Shirehampton. Mr. A. P. I. Cotterell, C.E., of Bristol, attended and explained his scheme.

RIVERS POLLUTION ACTS.—An inquiry was held at Yatton, by Mr. W. J. B. Clerk, Inspector to the Local Government Board, on the 22nd ult., with respect to an application of the Bedminster Rural Sanitary Authority for permission to take proceedings against Messrs. S. F. Cox & Son, tanners, for pollution of a stream at Claverham, near Yatton. Mr. O'Donoghue represented the Authority, and produced witnesses in support of the application, which was opposed by Mr. J. Nichols (Benson, Carpenter & Co.), who claimed that the stream in question was already a sewer, and that Messrs. Cox & Son had been throughout desirous of meeting every reasonable wish of the Authority. Mr. A. P. I. Cotterell, C.E., of Bristol, attended on behalf of Messrs. Cox & Son, and produced plans prepared by him for dealing with the tannery effluent.

WATER SUPPLY WORKS, FILTON, NEAR BRISTOL.—The Local Government Board have granted the application of the Authority for a loan for the purposes of carrying out works of water supply without an inquiry. Mr. A. P. I. Cotterell, of Bristol, is engineer to the works.

FOREIGN AND COLONIAL.

FRANCE.—The following architects have been appointed experts in connexion with the civil tribunal of the Seine:—MM. Auburtin, Laloux, Charles Lucas, Monduit, Roussi, Poulin, Roux, and Thomas.——M. Réné Dupont, who holds a Government diploma, has been appointed architect to the Colonial Ministry.——M. Fournereau, who is well known by his works on the Monuments of Cambodia, has been appointed Inspector of Museums and of Instruction in Drawing.——M. Lucien Doucet, painter, has been appointed Professor of Drawing at the Ecole Polytechnique, in place of M. Eugène Guillaume. M. Marius Roy, the military painter, has been appointed Master of Drawing at the same institution.——M. Rogerol has received the first premium in the first competition opened by the "Union Artistique du Nord."——The municipality of Coucarneau has decided on the erection of a hospital in that town.——A new railway station is to be built at Rouen, for the Rouen and Orléans line, at a cost of 740,000 francs.——The exhibition of decorative art at Nantes has just been opened under the presidency of M. Roger Marx, Inspector-General of Museums.——M. Paul Lebègue, sculptor (pupil of David d'Angers), has been commissioned to carry out the decoration of the "Carmel" at Meaux. The work, carried out in the style of the thirteenth and fourteenth centuries, will comprise some important groups and bas-reliefs, and also caryatides.——The old church of Bougival is at present in process of demolition, preparatory to its rebuilding on the same site. The ancient tower, which is classed as a "monument historique," has been saved, but only to be "restored" at a cost of 500,000 francs, left for the purpose by a generous but ill-advised donor. The church itself was in a dangerous condition, and could not be retained.——The new bridge at Argenteuil is to be opened shortly. It will form the second portion of the conduit for the Paris sewage to the plain of Achères. The syphon at Clichy, recently opened, formed the first. M. Berlier, the engineer, has received the decoration of the Legion of Honour.

GERMANY.—The Emperor, it is now announced, will open the New Imperial Houses of Parliament on the 5th. On the 7th a banquet will be given to Herr Wallot, the architect, by the United Berlin Art and Architectural Societies.——The applications for space at the 1896 Industrial Exhibition are so numerous that in the case of several sections additional space has had to be provided. The Municipality of Berlin has formally handed over the Treptow Park to the Works Committee; the well-known architects, Messrs. Bruno Schmitz, Griesebach, and Hoffacker, have been entrusted with the preparation of the plans for the buildings.——Professor Schlichting, the well-known Professor of Waterway Construction at the Charlottenburg Technical College, has died in his sixtieth year after a long and severe illness. He was for many years President of the Society for the Improvement of German River and Canal Navigation.——The Architekten-Verein held a special meeting on the 19th inst., in commemoration of Geheimer Baurath Schmedler, who died in June last. Geheimrath Sarrazin, who presided, sketched his career. He was born in Berlin, in 1823, and educated there. His first success was in 1850, when he carried off the first premium in the competition for the design for a Rhine Bridge, at Cologne. In 1858 he obtained an important appointment in the Railway Department, and was principally employed in superintending construction in the Rhine district. In 1866 he was appointed lecturer on bridge construction at the Berlin Architectural Academy, becoming in 1868 Geheimer Baurath, and as such responsible for the plans of all the great engineering works on the German railways until his retirement in 1891. Herr Sarazzin proceeded to say that in the period between 1870 and 1890 no large building work, bridge, viaduct, or span, was executed in Germany, the plans of which were not based on the results of Schwedler investigations.——Schools are to be erected in the Strelitzerstrasse and in the Glogauerstrasse at Berlin, at a cost of about 26,000*l.* each.——Parts of the foundations of the Roman bridge at Heidelberg have been discovered whilst laying pipes below the new bridge in the Neuenheim quarter.——The Roman Castellum close to the railway-station at Weissenburg has been now completely opened up by Herr Kohl, of the "Limes" Commission. On either side of the Prætorium traces of buildings of considerable size were discovered, as well as remains of barracks. The fort formed a square, the sides being 170 mètres long, or 560 ft.; there was a portal on each front flanked by towers. Towers at the four corners, as well as twelve others equally distant at the sides, completed the defensive works.

MISCELLANEOUS.

ARCHITECTURAL ASSOCIATION—DISCUSSION SECTION.—The second meeting of the Session was held at 56, Great Marlborough-street, on the 28th ult., when a paper on "Joinery" was read by Mr. E. Howley Sim, A.R.I.B.A. The chair was occupied by Mr. W. Henry White, and Mr. H. D. Searles-Wood attended as special Visitor. Messrs. Stockdale, Waymouth, and others joined in the discussion which followed the paper.

TWO ITALIAN CANAL PROJECTS.—According to Italian journals projects are on the *tapis* for the construction of two important canals in Italy. One, framed by Signor Vitotrio Bocca, engineer, advocates the construction of a canal between the Tyrrhenean and Adriatic Seas. It would be 200 kilomètres in length, and run from Montalto di Castre, in the province of Rome, cut through the peninsula in a north-easterly direction, and strike the east coast at Fairo. The width of the canal is to be 80 mètres and the depth 12 mètres, rendering it navigable for the largest vessels afloat. At the same time the swamps and lakes at Bolsena, Chiusi, Montepulciano, with Lake Trausimenia, are to be drained, whereby 950 square kilomètres of arable land would be recovered. The cost of this scheme is estimated at about six hundred million lires. A smaller scheme is advanced by two engineers, Faggari and Morandini. They advocate the construction of a canal 37 kilomètres in length, through the peninsula, Reggio, in the province of Cotenzaro. It is to run from the Bay of Santa Euphemia, on the Tyrrhenean Sea, along the bed of the river Amata, through the watershed of the two seas, and follow the bed of the river Caraces to the Bay of Squillace, on the Ionian Sea. This canal would obviate the detour for vessels around Sicily on the voyage through the Strait of Messina. The *entrepreneurs* calculate that the cost of the scheme would be covered by the recovery of 80,000 hectolitres of arable land along the beds of the rivers referred to.

ELECTRIC LIGHTING, BOURNEMOUTH.—The Lighting Committee of the Bournemouth Corporation have recommended the Town Council to accept the offer of the Bournemouth and District Electric Light Company to supply current to the Winter Gardens at a reduction in cost of 25 per cent. This was in consequence of a report by Mr. E. Matthew Lacey, Consulting Engineer, proposing a scheme for the Corporation to generate their own current, by which a saving of 150*l.* per annum was shown. Mr. Lacey also reported on the proposed scheme for lighting the pier and pleasure-grounds.

A SMOKE-CONSUMING GRATE.—Our attention has recently been called to the kitchen-ranges, stoves, &c., of the Economic Smokeless Fire Company, Limited, of Shaftesbury-avenue. It is claimed for these "patent fires" that they practically consume their own smoke, and that the process is accompanied by the evolution of great heat; therefore, this should not only form an important addition to the apparatus at present devised for abating the smoke nuisance, but effect considerable economy in the matter of fuel. An opportunity was afforded us of examining the system in detail, and we are perfectly satisfied with the results. We noticed tha the principle involved is not absolutely novel, though there is sufficient departure from other methods to enable us to regard the arrangement as a whole in the light of a new invention. The smoke generated by the fire is made to pass downwards (the fire being lighted from the top), it then ascends into a hot-air chamber situated at the back of the fire properly so-called, in which chamber it is completely burnt, the only product passing and collected in the flue being earthy mineral matter which constituted an impurity in the coal. The amount of this residuum is not, therefore, controlled by the hot air, but is entirely dependent on the class of coal used. It follows that very little soot is formed in the chimney, even with large fires. In order to procure the best results, the fire must be fed with small coal or coal-dust; at the time of our visit ordinary slack coal at 10s. 6d. per ton in London was being used. The bottom of the fire-box consists of two grooved or cogged rollers, which, turning inwards by a simple arrangement, serve to stir the fuel and remove ash. The rate of combustion is controlled by the use of strips of iron like a venetian blind which take the place of the iron bars usual in ordinary grates, and also by dampers. The only time when it is possible for smoke to pass up the chimney is when the fire is first lighted, before the air chamber at the back becomes heated. After the coal is once well alight and the hot air has commenced to do its work the smoke emitted from the chimney, according to experiments made by the Manchester Corporation and others, is practically *nil* during the whole day. There seem to be several points in favour of this invention: it can be applied to every class of fire without distinction, and in some cases the surplus heat from the hot-air chamber is added to that of the fire itself in warming the room, by a species of ventilating apparatus: as before stated, it practically prevents smoke, and whilst it saves fuel by generating greater heat in proportion to the quantity used than in ordinary fires, it enables an inferior coal to be employed, especially in the kitchen. From the point of view of smoke-abatement alone we commend this matter to the notice of architects.

PARTNERSHIPS.—Mr. Louis Jacob, of New Cross, and Mr. J. Arthur Brand, have entered into partnership as architects in Gresham-street, City, under the style of Jacob & Brand.——Mr. Coath Adams, architect, of London, has entered into partnership with Mr. J. H. Keats, of Plymouth, under the style of "Keats & Coath Adams."

CEMETERY, KING'S NORTON.—An inquiry was held at the Institute, King's Heath, on the 22nd ult., before Mr. F. H. Tulloch, M.Inst.C.E., one of the Inspectors of the Local Government Board, as to an application by the King's Norton Rural Sanitary Authority to borrow the sum of 10,500*l.* for the purchase of land for the purposes of a cemetery, and the fencing and laying out of the same. Mr. Edwin Docker conducted the case on behalf of the Authority, and Mr. R. Godfrey, Surveyor, explained the scheme. There was opposition from one adjoining land-owner only. After the inquiry the Inspector visited the site, and expressed himself as well pleased with the dryness of the subsoil.

THE CONFERENCE ON LIGHT RAILWAYS.—The Council of the Surveyors' Institution have nominated Mr. E. P. Squarey (Past-President) and Mr. C. Oakley (vice-President) to represent them at the Conference on Light Railways to be held under the auspices of the Board of Trade on the 6th inst.

ABERDEEN.—THE GRANITE TRADE.—During the financial year ended 30th September, the books of the Harbour Board show that the imports of timber by sea reached 2,682,208 cubic feet, an increase of about 25 per cent. on the previous year. As all the new buildings in Aberdeen have granite walls, the granite-quarries in the district reaped the advantage of the exceptional demand by obtaining better prices, though several master-masons complain of delay in the execution of orders for building-material. In the harbour financial year there were exported 22,106 tons of granite causeway stones (a rise of nearly 27 per cent. over 1892-3), 5,820 tons of granite kerb, pavement, and building stones; 11,258 tons of granite-chips and rubble, and 943 tons of road-metal. Of granite waste slabs or "adamantine," there were exported by sea 1,183 tons plain, and 28 tons enamelled or polished. "Adamantine" has also been used for covering the culverts in the electric light works in Aberdeen. In the ornamental and polished granite trade—in which about fifty yards are now exclusively employed—business during the year has been somewhat stiff, chiefly owing to the unsatisfactory state of matters in America, the scarcity of orders from which produced severe competition and low prices for the home trade. The total volume of the industry, however, has not been much under that of last year, though in some of the smaller works reductions in the number of hands were made. Some yards are now working short time, and granite merchants generally report the prospects for the winter as dull. The tariff question in America was settled too late in the season to be of material advantage this year, as shipments mostly cease about October; but in the early spring a special fillip to the trade in this direction is confidently expected. Other outlets for manufactured granite have been found. A large amount of work, both for monumental and architectural purposes, has been sent to the Continent, France especially going in largely for polished red granite, while South Africa, Australia, Russia, and New Zealand has each contributed its quota of orders. The harbour books show that 8,160 tons of rough granite were imported by sea during the year, as against 13,700 for the preceding year. These stones come mainly from Sweden, and though all classed as "granite," they include specimens defective either in quartz or mica, being, in fact, porphyry, or what is known in Sweden as "porphyr." In other cases, again, lime takes the place of felspar, and the stones are called "marmor" in Sweden, being really a kind of marble. Some architects at a distance insist, against the advice of the Aberdeen merchants, on getting green-coloured Swedish stones for polished fronts. The stones of this hue look beautiful when newly polished, but the brilliancy is evanescent, and fades fast on exposure, to the disappointment of customers; and the Americans have already abandoned their use for tombstones. The granite merchants in Aberdeen have not found any polished goods to last so well as the dark-grey or "blue" Rubislaw and the pink or "red" Peterhead stones. Polished specimens of these Aberdeenshire granites exist which from their compact grain do not appear to have altered in the least after from forty to sixty years' exposure. There is, however, a fair demand for Scandinavian "Labradorite," which looks well when polished. For the year ended 30th September, the total amount of polished granite exported from Aberdeen harbour was 6,448 tons, against 5,915 for 1892-3. This does not include the output for America (which is taken by rail to Glasgow and shipped there), nor for inland places. Statistics as to these cannot be got from the railway companies; but the demand for polished granite for the United States alone, though it is now principally confined to "red" stones, is at least double the quantity exported from the docks at Aberdeen. Among special work on hand, it may be mentioned that Mr. R. Simpson, North British Granite Works, has a good order for polished columns for a building near London, and is constructing two large monuments, one for Port Elizabeth and the other for Tasmania. Messrs. McIntosh & Rae, Lorne Granite Works, have in hand a coat-of-arms for Crathes Castle, and a large monument for abroad is being made at Victoria Granite Works. Mr. J. Hutcheon, King-street Cemetery Granite Works, is getting ready the pedestals, parapets, and balustrades for a bridge over the Kelvin, in the West-End Park, Glasgow, all of dressed Hill of Fare granite.

SOCIETY OF ENGINEERS.—The Council of this Society have unanimously elected Mr. S. Herbert Cox as one of the vice-Presidents in the place of Mr. Henry Faija, deceased, and Messrs. Henry O'Connor and William Bradford as members of Council.

THE SANITARY INSTITUTE.—At the meeting on the 12th inst. of the Sanitary Institute, at 8 p.m., a discussion on "The Sanitary Aspects of the London Building Act," is to be opened by Dr. G. B. Longstaff, chairman of the Building Act Committee of the London County Council, when other members of the County Council, members of Local Boards and Vestries, and those officers who will be concerned in carrying out the provisions of the Act, are expected to take part in the discussion.

BISHOPSGATE INSTITUTE.—The Adams Building Trades Emporium ask us to mention that their bolts were selected for the exit doors at this building.

CEMETERY, ALTRINCHAM.—The new cemetery at Altrincham was opened and dedicated to the public on the 21st ult., by Alderman Griffin, J.P., Mayor of Altrincham. The work has been carried out at a cost of 9,000*l.* The chapel, of fourteenth-century Gothic style, is faced with Halifax stone, and provides sitting accommodation for seventy people, besides mortuary, vestry, &c. The works have been carried out from the designs and under the superintendence of Mr. Wm. Owen, architect, of Manchester. Mr. John Matthews, of Nantwich, was the principal contractor, and the other contractors were:—Heating, Mr. James Smith, Altrincham; mosaic floor, &c., Messrs. J. & H. Patteson, Manchester; stained glass, Mr. James Jones, Manchester; entrance gates, &c., Messrs. Cunliffe & Dean, Manchester; boundary-wall, Mr. J. H. Holt, Altrincham.

BUILDERS' CLERKS' BENEVOLENT INSTITUTION.—A special general meeting for the election of one pensioner and one orphan took place at the offices of the Builders' Clerks' Benevolent Institution, 21, New Bridge-street, E.C., on the 28th ult., the President, Mr. William Shepherd, occupying the chair. There were two candidates for the pension, viz., Mrs. S. A. Bennett and Mrs. S. Lovett; and two for the orphan vacancy, viz, Kate C. Hill, aged 9, and Helena M. Smith, aged 3. The poll commenced at 7 p.m., and soon after its close, at 8 o'clock, the result was made known as follows:—For Pension—Mrs. Bennett, 1,108 votes; and Mrs. S. Lovett, 537 votes. For Orphan Vacancy—Kate C. Hill, 880 votes; and Helena M. Smith, 494 votes. The Chairman then announced that the successful candidates were Mrs. S. A. Bennett, who would receive the widows' pension of 20*l.* per annum, and Kate C. Hill, who would be admitted in January next to the Orphan Working School, Maitland Park, per presentation of the Institution. The scrutineers, Messrs. Ernest S. Rider, T. Stirling, jun., and H. W. Parker, were then thanked for their services, followed by a vote of thanks to the President for his kind attendance and occupancy of the chair.

THE LONDON COUNTY COUNCIL IN PARLIAMENT—SESSION 1895.—The Council will apply for leave to bring in Bills for the following purposes:—A new approach to Tower Bridge from the south, by a road to Tooley-street (opposite the bridge) from the junction of Old Kent-road and Bermondsey New-road. The proposed thoroughfare will consist of a widening of Bermondsey New-road along a portion of each side, a new road from Grange-road to Artillery-street, and a widening of Church-row, Horseleydown. It appropriates the sites of Providence-place and Bermondsey-square, which represents the Close of the Cluniac monastery, and is entered from Grange-road and Abbey-street through openings where stood the gates; the great north gate remained until 1807. For this project the Council will frame an Assessment or Provisional Award, describing the lands which in their opinion should bear and pay the Improvement charge. To rebuild Vauxhall Bridge on the present site, and provide in the meantime a temporary bridge at a point opposite the site of the old prison entrance at Millbank, where the British Gallery is now in course of construction. The late Metropolitan Board of Works bought for 255,230*l.* the existing bridge which, opened in June, 1816, had cost 300,000*l.*, the law charges being 70,000*l.* in addition. Ralph Dodd's design for a stone bridge of nine arches with a span of 78 ft. was ultimately modified and James Walker adopted iron arches, to lower the expenses. A Bill for altering the system now in force with respect to the valuation and assessment of hereditaments and property, with the repeal of certain Acts *ad hoc*, so far as they relate to London. It is proposed to set up Assessment Committees for unions and parishes, to appoint a valuation court for hearing appeals against valuation lists, and to make new provisions for the valuation of railways, tramways, canals, docks, water, gas, and hydraulic power works, and of telegraph, telephone, and electricity works which extend into more parishes than one, special yearly valuations being made for the last-named. To work the tramways acquired by them. To purchase by agreement or arbitration the several undertakings of certain waterworks companies—namely, Lambeth, first established in 1785 at Belvidere; Southwark and Vauxhall; Kent (1809); East London (1853); Chelsea, founded in 1724; Grand Junction, projected in 1798, and since 1820 supplied from the Thames; West Middlesex, established in 1806; and the New River, whose earliest Acts of Parliament are of 13 Elizabeth and 3 and 4 James I. Their "general powers" Bill comprises the following projects: to widen the east side of Blackstock-road, Islington, between the two points opposite Myrtle-mews and Elwood-street, the Vestry contributing; to widen the south approach to Woolwich Ferry; to acquire Nos. 2—8 and 22—8 (even), Winchester-terrace, Causton-street, with Nos. 1—7 (odd), Vincent-street, for making approaches to the ground to be acquired by the Council for working-class dwellings on the Millbank Penitentiary site; to widen Ben Jonson-road, Mile End Old Town, on its north side, between High- and Ocean-streets, the Mile End Vestry and Limehouse Board of Works contributing; to acquire a plot and buildings adjoining St. Alphege, Greenwich, Recreation-ground, for a Coroner's Court, a Weights and Measures Office, and a Mortuary; also a site at the north-west corner of Drummond-street, Hampstead-road, and four houses in Florence-street, Islington, for purposes of the Fire Brigade; to further provide as to boat-hire and the formation of gymnasia in parks and open spaces under their control; to provide for contribution by the Plumstead Vestry to the purchase of lands as an addition to Bostall Heath, and similarly by the Greenwich Board of Works in respect of an open space in St. Paul's parish, Deptford, such moneys to be charged only on St. Paul's parish (which, by an independent Bill prepared for next Session, is to be separated from Greenwich district); by the Poplar Board of Works for an open space in the Isle of Dogs; by the Lambeth Vestry for the additional entrance into Brockwell Park; and by the Lee Board of Works in respect of an open space at Manor-lane, Lee. The Council seek to effect a re-arrangement of polling districts for their own elections, as well as for Parliamentary and County Council purposes; and an alteration of wards in parishes and districts, together with the several numbers of vestrymen representing the same; and to determine an untoward state of things now existing by granting a pension to the chairman of Court of Quarter Sessions for the County of London. They have resolved, further, to apply, as from the 15th inst., their code of by-laws, lately approved by the Home Secretary, to the parks, gardens, and open spaces, already seventy-four in number, vested in them and under their management.

ANNUAL SOIREE OF EDINBURGH PLASTERERS.—In the Oddfellows' Hall, Edinburgh, the annual soirée and concert under the auspices of the local branch of the Scottish National Operative Plasterers' Federal Union was held on the 16th ult. Councillor Waterston, who presided, said they formerly had the Plasterers' Society, a comparatively local society, and that seven or eight years ago the Federal Union was formed. It spoke volumes for the trade that now nearly if not all the journeymen plasterers in Scotland were members of that union. He believed that if ever working-men were to benefit themselves it must be by helping each other. He was glad to know that through an arbitration board there had been a congenial method of working for a considerable time, and that wages would probably be increased a halfpenny per hour at the beginning of 1895.

GLASGOW SCHOOL OF ART.—The third of the series of lectures on "Mediæval Architecture" was delivered on the 21st ult., within the Corporation Galleries, by Mr. Alexander M'Gibbon, architect. The subject was principally the second period of English architecture, the work of the transition from Romanesque to Gothic, in this country from Norman to Early English. Although the term Transitional is generic, it is well understood as applying particularly to the style current with us during the second half of the twelfth century. It is the assimilation of Norman tastes and methods with the indigenous Saxon traditional practices, before the pointed Gothic was accepted from Royal France, and a complete break made with Romanesque usage. The pointed arch that in France was employed because of structural necessity, where vaulting was conceived of as essential, when imported to England was first used as much because of its novelty, for groined vaulting was not by us universally desired, so the semi-circular arch was equally favoured. This, with much of Norman ornament refined and elaborated, joined to the greater elegance and loftiness of arches and columns that is characteristic of the Early English style which succeeded constitutes the excellence of Transitional. In Scotland the finest examples are found at Jedburgh, Kelso, Dryburgh, and Kilwinning, Abbeys though

COMPETITIONS, CONTRACTS, AND PUBLIC APPOINTMENTS.

COMPETITIONS.

Nature of Work.	By whom Advertised.	Premiums.	Designs to be delivered.
School Buildings, near Huddersfield	Shepley School Board	*Official*	Dec. 31
*Workhouse and Infirmary	Ipswich Union	100*l.* and 50*l.*	Mar. 25'95

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.
Shops, Offices, &c. Church-lane and Ann-street, Belfast	Philip Duffy	E. & J. Byrne	Dec. 4
Roads, Paths, &c. Porthcawl, Wales	Lord Wimborne	Lambert & Rees	do.
Additions to Millfield House, Keswick	.....	J. S. Moffat	do.
*Making-up Roads	Tottenham Local Bd.	P. E. Murphy	do.
*Making-up West Hill, Sydenham	Lewisham Bd. of Wks.	*Official*	do.
*Making-up Queen's-road, Forest Hill	do.	do.	do.
New Streets, Ryecroft	Rawmarsh Local Board	do.	do.
Drainage, Cowbridge-road, near Caerau	Glamorgan C. C.	do.	Dec. 5
Additions to Ashfield, Halifax	.....	Petty & Ives	do.
Alterations, &c. to Manor Hotel, Lee, Ilfracombe	.....	W. C. Oliver	do.
*Paving Works	Camberwell Vestry	O. S. Brown	do.
Mortuary at Hospital, Holly-lane	Smethwick Local Bd.	J. C. Stuart	do.
Pipe Sewers, Bonny Muir and Hosefield	Aberdeen Town Coun.	Wm. Dyack	Dec. 6
Sewerage Works, Fishburn, Durham	Sedgefield R.S.A.	Wm. Snowdon	do.
Buildings, Clifton-street, Belfast	Ulster, &c. Hospital	Mr. Hunter	do.
Additions to Schools, Bardsea, near Ulverston, Lancs.	Rev. E. Geoghegan	.....	do.
*Stepway, St. Pancras	M. R. Co.	*Official*	Dec. 7
Semi-detached Villas, Moor-lane, Ovenden, Yorks.	.....	W. H. D. Horsfall	Dec. 8
Laying Drain Pipes, &c. Bowmore, Islay, N.B.	Argyll County Council	W. R. Copland	do.
*Supply of New and Purchase of Old Stores	G. N. R. Co.	*Official*	do.
Sewerage Works (four contracts)	Barnoldswick Loc. Bd.	Brierley & Holt	Dec. 10
Club Premises, Chapel Hill, Morley, Yorks	Conservative Buildings Co. Lim.	J. W. Burrows	do.
Drainage, Duke's-road	Southampton Corp.	W. B. G. Bennett	do.
Additions to Schools, Holton-road	Barry (Glam.) U.D. School Board	Geo. Thomas	do.
Business Premises, William-street, Ystrad Rhondda, Wales	D. Lloyd	.....	do.
*Chimney Stack	King's Norton U.R.S.A.	R. Godfrey	do.
Street Works, Marlow-street, &c.	Walsall Corporation	*Official*	do.
Pier, Causeway, &c. Gortmore, co. Galway	Congested Districts Bd. of Ireland	do.	Dec. 11

CONTRACTS—*Continued.*

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.
*West-street School	Farnham School Board	A. J. Nash	Dec. 11
*Cast-iron Pipes	Sandgate Local Board	H. E. Stilgoe	do.
*Making-up Road	Poplar & Stepney Sick Asylum District	G. E. Holman	do.
*New Class-room	Harrow-on-the-Hill with Pinner Sch. Bd.	Houston & Houston	do.
*10-ton Steam Road Roller	Borough of West Ham	L. Angell	do.
Widening, &c. School-street, New Tredegar, Mon.	Bedwellty Local Board	J. H. Lewis	Dec. 12
Pipe-sewers and Pipes, near Preston	Longridge Local Board	T. S. McCallum	do.
*Roadmaking and Paving Works	Fulham Vestry	C. Botterill	do.
*Additions to Wards at Union House	Woolwich Union	J. O. Cook	Dec. 13
Artesian Boring (1,450 feet deep)	Gainsborough Loc. Bd.	Jabez Church	Dec. 14
Iron Bridge over River Dee, Queensferry	Flint County Council	T. W. Barber	Dec. 15
Pipes and Pipe-laying, Crossbarrow	Cockermouth U.R.S.A.	J. B. Wilson	do.
*School Buildings	West Ham School Bd.	Newman & Jaques	Dec. 18
*Tar-Paving Works	Parish of St. Leonard's Shoreditch	F. I. Smith	Dec. 19
*Twelve Workmen's Cottages	Kingston-on-Thames Corporation	*Official*	do.
*Municipal Technical School	Manchester Corp.	Spalding & Cross	Dec. 31
*Additions, &c. Donaghonoyne House, co. Monaghon	J. M. Bolton	R. P. T. Logan	Jan. 1'95
Sewage Disposal Works, &c.	Trawden (Lancs) Local Board	Wm. Dent	Jan. 5
*Waterworks	Skibbereen Union, co. Cork	R. W. Walsh	Jan. 12
House and Farm Buildings, Bure, near Bournemouth	Major Stuart Wortley	Lawson & Donkin	No date
Mission Hall, Park-street, Rhosddu, Wrexham	.....	T. C. Williams	do.
Roadmaking and Sewering, "The Downs," Luton	.....	Roberts & Bird	do.
Chapel, Huntspill, Somerset	.....	H. D. Pitts	do.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.
*Master to Superintend Technical Education	School at Lagos	250*l.* &c.	Dec. 3
*Building Inspector	Willesden Local Board	150*l.*	Dec. 4
*Outside Foreman	Bridgwater Trustees	.....	No date

Those marked with an asterisk (*) are advertised in this Number. *Competitions, p.* iv. *Contracts, pp.* iv., vi., viii., *and* xxiv. *Public Appointments, pp.* xxii.

it is met with as far north as Elgin, and even in Kirkwall. At Jedburgh the western doorway is of particular beauty. Limelight illustrations were shown of many examples in France, England, and Scotland. Thereafter a brief sketch was given of the social economy of the cathedral, abbey, and parish church, so far as to permit of an understanding of the functions of the architectural forms and arrangements met with in these buildings.—*Glasgow Herald.*

MEETINGS.

FRIDAY, NOVEMBER 30.

Institution of Civil Engineers (Students' Meeting).—Mr. Charles H. Olley on "Sub-aqueous Excavation at Newry." 8 p.m.

Sanitary Institute (Lectures for Sanitary Officers).—Professor A. Wynter Blyth on "Sanitary Law, English, Scotch, and Irish; General Enactments Public Health Act, 1875; Model By-laws, &c." 8 p.m.

Glasgow Architectural Association.—Annual Conversazione.

SATURDAY, DECEMBER 1.

Sanitary Inspectors' Association.—(1) Mr. F. H. Cheesewright on "The Economic Treatment and Disposal of Town and Dust-bin Refuse." (2) At the conclusion of the Meeting the Chairman will declare it open for a Conference of Members for Discussion of matters of general interest. 6 p.m.

Northern Architectural Association (Masonic Hall, Sunderland).—Mr. F. Caws on "The Architect." 7.30 p.m.

Queen's College, Cork.—**Mr. Arthur Hill on "The History of Architecture." II. 3 p.m.**

SUNDAY, DECEMBER 2.

South-place Institute.—Mr. D. Hennessey on "The History of Plastering and its Relation to the Health of the People." 4 p.m.

MONDAY, DECEMBER 3.

Royal Institute of British Architects.—Business meeting and election of new members. A question connected with the Statutory Examination for certificates to act as District Surveyor to be raised. 8 p.m.

A.A. Camera Club.—Mr. E. W. M. Wonnacott on "Camera Studies of Architecture." 8 p.m.

Sanitary Institute (Lectures for Sanitary Officers).—Dr. Louis Parkes on "Sanitary Laws and Regulations Governing the Metropolis." 8 p.m.

Society of Engineers.—Mr. H. B. Ransom on "The Principles and Practice of Hydro-Extraction." 7.30 p.m.

Society of Arts (Cantor Lectures).—Professor Vivian B. Lewes on "Modern Developments in Explosives." II. 8 p.m.

Liverpool Architectural Society.—Alderman P. H. Rathbone on "The Economic Value of Fine Architecture." 6.30 p.m.

Glasgow Philosophical Society.—Mr. T. Gildard on "An Old Glasgow Architect on Some Older Ones." 8 p.m.

TUESDAY, DECEMBER 4.

Institution of Civil Engineers.—(1) Further Discussion on Mr. A. J. Durston's paper on "The Machinery of War-Ships." (2, time permitting) Mr. Edw. B. Wain on "Colliery Surface-Works." 8 p.m.

University Extension Society (Chelsea Town Hall).—Mr. Arnold Mitchell on "English Architecture." IX. 3 p.m.

Society of Biblical Archæology.—8 p.m.

Glasgow Architectural Association.—**Mr. C. J. Davidson on "Planning of Farmhouses." 8 p.m.**

WEDNESDAY, DECEMBER 5.

British Archæological Association.—(1) Miss Russell on "Fortifications of Timber in Early Times." (2) Mr. J. T. de Raads on "The Fleurs de Lys of the Ancient French Monarchy." 8 p.m.

Society of Arts.—Mr. Edwin O. Sachs on "Fire Protection." 8 p.m.

Builders' Foremen and Clerks of Works' Institution.—Ordinary Meeting of the Members. 8 p.m.

Liverpool Engineering Society.—8 p.m.

Carlisle Architectural, Engineering, and Surveying Association.—Mr. E. B. Newton on "Gauging the Flow of Water."

Northern Architectural Association.—Mr. D. H. S. Cranage on "The Elizabethan and Renaissance Periods." 7.30 p.m.

THURSDAY, DECEMBER 6.

Society of Antiquaries.—8.30 p.m.

FRIDAY, DECEMBER 7.

Architectural Association.—Mr. E. O. Sachs on "The Modern Theatre of the Continent." 7.30 p.m.

Institution of Junior Engineers.—Mr. W. Mallock on "Waterworks and Appliances." 8 p.m.

SATURDAY, DECEMBER 8.

Queen's College, Cork.—Mr. Arthur Hill on the "History of Architecture." III. 3 p.m.

RECENT PATENTS:

ABSTRACTS OF SPECIFICATIONS.

23,589.—FLUSHING DRAINS, &c.: *J. A. Noel.*—A device principally adapted for cottage property. A sunk receiver, trap, or tank is fixed in connexion with the yard gully, rain-water pipe, &c. This trap has an outlet and an enlarged socket, and a bend as interceptor. A plunger passing through the cover is used to force the water for flushing at intervals.

24,380.—WINDOW-SASHES: *W. Nicol.*—This is a somewhat elaborate arrangement of mounting the sliding frames of sash windows with a central tube or rod, on which they may be carried and reversed within the apartment for cleaning or such like purpose.

24,635.—ATTACHMENT TO T SQUARES: *Scott Addison.*—To prevent T squares from becoming displaced, a clip or cramp is provided. This clip has springs and rollers fixed so that the rollers are pressed against the edge of the drawing-board. The stock of the square is firmly pressed against the working edge of the board, and the blade cannot be forced out of the perpendicular by the pressure of the hand or arm of the user.

1,047.—COLLAPSIBLE DOORS: *W. Bonfils* (Denmark).—To partition off rooms or to act as a door, framing is put up, and to this is fitted a series of wooden bars mounted with metal strips, which enable the door to be collapsed or pressed into a small space at the side of the frame when it is not required to use it.

9,883.—VARNISH: *L. Meyer* (Hamburg).—A varnish to withstand the action of heat and steam or hot and cold water is made from "fat-tar" mixed with oxides of lead, heated till they chemically combine. The varnish is mixed with turpentine.

17,059.—PAVEMENTS: *J. H. Amies and another.*—Paving-blocks are composed of bog-peat, turf, or vegetable fibres compressed and amalgamated by a resinous compound impervious to moisture.

17,544.—PAINT-REMOVING COMPOUND: *E. Tessen.*—This is made by adding to the ordinary compound used for the purpose a soap, produced by combining linseed-oil with a caustic lye, and mixing this mass with hydrate of lime. This, while it destroys the paint or lacquer, does not injure the wood.

17,597.—MAKING MORTAR: *F. L. Moores* (U.S.A.).—A building in which machinery designed for making mortar on a wholesale or organised scale is described in the specification, the objects principally aimed at being the production of mortar of a given strength, economy in time, uniformity, and thorough mixing of the ingredients.

17,655.—CHIMNEY-POTS: *F. J. Orwin.*—An inside shaft, straight cylinder shaped, has an outer cylindrical casing tapered from the base and provided with a cup-shaped head, the effect of which is to deflect the current of air from the sides of the chimney-pot, and prevent down-draught.

NEW APPLICATIONS FOR LETTERS PATENT.

NOVEMBER 12.—21,780, A. Harkess, Producing extra pressure in the testing of drain and other pipes.—21,797, C. Godfrey and W. Butlin, Automatic Window Fastener.—21,801, C. Sabow, Extending Ladders.—21,836, M. Sankey, Surveying Instruments.

NOVEMBER 13.—21,862, A. Gregson, Draught Excluders.—21,876, J. Whitehead, Bolts for windows, doors, gates, &c.—21,904, S. Smith, Gates.—21,937, J. Barber, Ventilating drains and sewers.—21,941, H. Shepherd, Hollow Walls.

NOVEMBER 14.—21,970, F. Thackeray, Gully Dish and Grate.—22,001, W. Youlten, Fireproof Construction.—22,012, H. Hunt, Fire Grates and Stoves.—22,024, J. Farley, Joints of Earthenware or other Pipes.

NOVEMBER 15.—22,056, G. Lear and J. Davison, Concealed Chimney-smoke Cure.—22,063, C. Heyworth, Lavatory Wash-basins, Baths, &c.—22,073, G. Marsden, Tiles.—22,074, J. Hodge, Water-waste Preventing Cisterns.—22,078, W. Nicol, Ventilators.—22,100, A. Boult, Damp-proof Paints, &c.—21,118, S. Dean, Tiles.

NOVEMBER 16.—22,137, D. Sinclair, Household Furniture, Chimney-pieces, Baths, &c.—22,149, G. Anderson, Stone-sawing Machinery.—22,152, D. Arnot, Sash-windows.—22,178, E. Barnett, Fresh Air Inlet.

NOVEMBER 17.—22,234, J. Merryweather, Fireproof Curtains for theatres.—22,260, R. Evans, Manufacture of Size.—22,277, C. Cooze, Window Sashes, &c.

PROVISIONAL SPECIFICATIONS ACCEPTED.

17,238, J. Spear, Apparatus to stop the noise of inrush of Water to Water-closet Tanks.—19,956, W. Calvert, Sink-traps, &c.—20,136, F. Hughes, Automatic Duplex Door-stop and Holdfast.—20,446, S. Rowley, Lavatories, Sinks, &c.—20,450, L. Shedden, Chimney and Ventilating Cowl.—20,554, G. Milward & B. Nicklin, Chimney Cowls.—20,736, J. Stein, Kilns for Firing Bricks, Pottery, &c.—20,803, J. Janssen, Lime-kiln.—20,869, G. Bowman, Fire-proof Doors, &c.—21,099, W. Purdy, Road Pavement.—21,212, W. Mockett, Window-sash Holder.

COMPLETE SPECIFICATIONS ACCEPTED.

(Open to Opposition for Two Months.)

21,971, H. Blake & G. Day, Sash-hanging.—22,873, J. Moore, Step-ladders.—586, A. Chocarné, Flooring Girders.

SOME RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

NOVEMBER 15.—By *Dyer, Son, & Hilton* (at Lee): 70, 72, and 74, Loampit Vale, Lewisham, u.t. 68 yrs., g.r. 22*l.* 10s., r. 105*l.*, 1,440*l.*; 6, Burnt Ash-rd., Lee, u.t. 59 yrs., no g.r., r. 40*l.*, 68*l.*

NOVEMBER 19.—By *Hampton & Sons:* No. 10, Palace Gardens, Kensington, u.t. 48 yrs., g.r. 110*l.*, 11,200*l.*; 8, Palace Gardens Mews, u.t. 48 yrs., g.r. 8*l.*, 1,600*l.*; "Morden House," near Royston, and 13 acres, f., 2,500*l.*—By *Moss & Jameson:* 43 and 57, Star-st., Edgware-rd., u.t. 38 yrs., g.r. 8*l.* 8s., r. 56*l.*, 1,015*l.*; 11, West Hill, Highgate, u.t. 17 yrs., g.r. 1*l.*, 825*l.*; 5 and 6, Seymour-ter., Finchley, u.t. 87 yrs., g.r. 15*l.* 10s., r. 100*l.*, 900*l.*; 2, Seymour-ter., u.t. 17 yrs. g.r. 7*l.* 15s., 440*l.*—By *G. Gouldsmith, Son, & Co.:* 18 and 20, Tedworth-sq., u.t. 57 yrs., g.r. 22*l.* 2s., r. 135*l.*, 1,065*l.*; 16, Coulson-st., u.t. 47 yrs., g.r. 6*l.* 10s., r. 28*l.*, 330*l.*: 52, Lamont-rd., u.t. 72 yrs., g.r. 2*l.* 5s., r. 45*l.*, 505*l.*; 68, Westbourne-st., Belgravia, u.t. 26 yrs., g.r. 5*l.*, r. 32*l.*, 365*l.*; 47, Sloane-st. and 71, 73, and 75, Pavilion-rd., u.t. 14 yrs., g.r. 395*l.*, r. 770*l.*, 1,000*l.*; 5, South-st., Thurloe-sq., u.t. 11 yrs., g.r. 9*l.*, r. 75*l.*, 280*l.*; 36, Elm-pk.-rd., Kensington, u.t. 79 yrs., g.r. 2*l.*, 1,000*l.*; 11, Lurline Gardens, Battersea, u.t. 82 yrs., g.r. 8*l.* 7s. 6d., r. 50*l.*, 350*l.*

NOVEMBER 20.—By *C. & H. White:* F.g.r. of 6*l.* 10s., Mawbey-rd, Old Kent-rd., reversion in 22 yrs., 560*l.*; f.g.r. of 6*l.* 10s., Mawbey-rd., reversion in 23 yrs., 205*l.*; f.g.r. of 6*l.* 12s., Mawbey-rd., reversion in 24 yrs., 200*l.*; 17, Wimbledon Park-rd., Wandsworth, f., r. 47*l.* 13s. 4d., 195*l.*; 8, Sutherland-sq., Walworth, r. 34*l.*, and a l.g.r. of 4*l.* 10s., u.t. 48 yrs., g.r. 8*l.*, 295*l.*; 269 to 279 odd, Latimer-rd., Notting Hill, u.t. 49 yrs., g.r. 44*l.*, 295*l.*—By *W. Houghton:* 7, Delafield-rd., Charlton, u.t. 78 yrs., g.r. 3*l.* 10s., r. 28*l.*, 260*l.*—By *W. W. Read & Co.:* 71, 73 and 75, Cator-st., Peckham, u.t. 68 yrs., g.r. 12*l.*, r. 85*l.* 16s., 435*l.*—By *E. Robins & Hine:* 7, Wilton-pl., Belgravia, u.t. 28 yrs., g.r. 6*l.*, r. 174*l.*, 2,000*l.*; i.g.r. of 72*l.* 9s., Carlisle-pl., Edgware-rd., u.t. 27 yrs., g.r. 46*l.* 8s., 280*l.*—By *Alfred Richards:* "Eagle House," Edmonton, f., 1,470*l.*; 49, Park-rd., West Ham, f., 380*l.*; 45 and 47, Devonshire-st., Mile End, u.t. 28 yrs., g.r. 4*l.*, 145*l.*—By *S. Walker & Runtz:* "Fernside," and 1 acre, Caterham, f., 1,460*l.*; 11, Sherborne-st., Blandford-sq., u.t. 43 yrs., g.r. 7*l.*, r. 48*l.*, 425*l.*; 31, Sherborne-st., u.t. 52 yrs., g.r. 7*l.*, 380*l.*; 20, King-st., Covent Garden, u.t. 8 yrs., g.r. 90*l.*, r. 156*l.*, 580*l.*; 121 and 123, Fairfax-rd., Harringay Pk., u.t. 94 yrs., g.r. 10*l.*, 325*l.*—By *Driver & Co.* (at Clun): Castle Farm, Clun, Shropshire, 134a. or. 12p., f., in nine lots, 3,295*l.*

NOVEMBER 21.—*By Bedford & Co.:* 29, Lower Seymour-st., Portman Estate, u.t. 23 yrs., g.r. 100*l.*, 1,850*l.*; 20, Queen Anne-st., u.t. 2 yrs., g.r. 80*l.*, r. 260*l.*, 325*l.*—*By Douglas Young:* 35, Thorn-st., Wandsworth-rd., u.t. 39 yrs., g.r. 6*l.*, r. 30*l.*, 220*l.*—*By Robert Reid:* F.g.r. of 30*l.*, Cornwall-rd. and Wootten-st., Lambert, reversion in 19 yrs., 1,085*l.*; f.g.r. of 82*l.* 4s., Wootten-st., Wootten-court, and Windmill-st., reversion in 18 yrs., 2,735*l.*; f.g.r. of 61*l.* 4s., Wootten-st. and Eaton-st., reversion in 20 yrs., 1,870*l.*; f.g.r. of 8*l.* 11s., Eaton-st., reversion in 19 yrs., 570*l.*; f.g.r. of 52*l.*, Wootten-st., reversion in 18 yrs., 3,435*l.*; f.g.r. of 56*l.* 15s., Wootten-st., Windmill-st., and Cornwall-rd., reversion in 18 yrs., 2,590*l.*; f.g.r. of 67*l.*, New Cut and Little Windmill-st., reversion of 13 yrs., 5,790*l.*

NOVEMBER 22.—*By Messrs. Cronk:* The residence "Nutlands," Ightham, Kent, and 3a. 2r. 33p., f., 1,000*l.*; two f. cottages with gardens, 560*l.*—*By F. J. Bisley & Sons:* 8, Southwark-pk.-rd., Bermondsey, u.t., 29 yrs., g.r. 4*l.* 10s., 215*l.*—*By Stimson & Sons:* 223, Rye-lane, Peckham, f. and l. sheds and yard, u.t. 17 yrs., g.r. 6*l.* 2s., 2,200*l.*; 44, 46, and 48, Ringcroft-st., Holloway, u.t. 50 yrs., g.r. 18*l.*, 790*l.*; 15, Glynn-st., Vauxhall, u.t. 71 yrs., g.r. 6*l.*, 345*l.*; "Holly Lodge," Beaulah-cres., Thornton Heath, f., 685*l.*; 14, Strathnairn-st., Bermondsey, u.t. 46 yrs., g.r. 5*l.*, 285*l.*—By *A. J. Sheffield:* 27, Cotton-st., Poplar, f., 245*l.*; 7, Wade-st., f., 290*l.*; 204 and 300, High-st., f., r. 61*l.* 7s., 405*l.*; 11 to 14, Sophia-st., u.t. 29 yrs., g.r. 10*l.* 10s., 140*l.*; 21, 22, and 23, Grove Villas, East India-rd., f., except yds., 800*l.*; f.g.r. of 4*l.*, Grove Villas, Poplar, reversion in 47 yrs., 105*l.*; 39, North-st., c., 85*l.*; 157, Salmon's Lane, Limehouse, f., r. 26*l.*, 325*l.*; 62, Selwyn-rd., Upton Manor, f., r. 26*l.*, 350*l.*; 15, Ricardo-st., Poplar, u.t. 34 yrs., g.r. 3*l.*, 90*l.*—By *Messrs. Trollope:* 32, Wilton-pl., Belgravia, u.t. 44 yrs., g.r. 69*l.*, 5,700*l.*; No. 61, Chester-sq., u.t. 29 yrs., g.r. 2*l.*, r. 250*l.*, 3,400*l.*; i.g.r. of 60*l.*, Belsize-pk., u.t. 57 yrs., g.r. 2*l.*, 1,335*l.*; i.g.r. of 135*l.*, u.t. 57 yrs., g.r. 5*l.*, 3,175*l.*; i.g.r. of 10*l.*, Belsize-pk., u.t. 57 yrs., g.r. 2*l.*, sold before auction.—By *H. J. Bliss & Sons:* 18, Longridge-rd., Earl's-ct., u.t. 77 yrs., g.r. 14*l.*, r. 100*l.*, 1,000*l.*; 191, Globe-rd., Bethnal Green, u.t. 9 yrs., g.r. 3*l.* 3s., 65*l.*; 50, Jane-st., St. George's-in-East, u.t. 6 yrs., g.r. 2*l.* 7s. 6d., 40*l.*; 137, Antil-rd., Mile End, u.t. 68 yrs., g.r. 2*l.* 8s. 4d., 290*l.*—By *Robert Reid:* F.g.r. of 94*l.*, New Cut, Lambeth, reversion in 13 yrs., 7,585*l.*; f.g.r. of 109*l.*, Lower Marsh and Coral-st., reversion in 17 yrs., 5,515*l.*; f.g.r. of 41*l.* 10s. 6d., Lower Marsh and Coral-st., reversion in 17 yrs., 1,610*l.*; f.g.r. of 48*l.* 13s., Lower Marsh, reversion in 13 yrs., 2,810*l.*; f.g.r. of 60*l.*, Oakley-st., reversion in 18 yrs., 2,020*l.*; f.g.r. of 9*l.*, Oakley-st. and Coral-st., reversion in 17 yrs., 390*l.*; 6 and 8, Oakley-st., f., r. 42*l.*, 830*l.*—By *Boyton & Pegram* (at Walham Green): 15 to 31 odd, Haldane-rd., Fulham, u.t. 63 yrs., g.r. 28*l.* 2s. 6d., r. 260*l.*, 2,275*l.*; 144, 146, and 148, Escourt-rd., c., r. 75*l.*, 650*l.*

NOVEMBER 23.—By *Ellis & Son:* 15, Upper Woburn-pl., Tavistock-sq., u.t. 28 yrs., g.r. 28*l.*, r. 120*l.*, 720*l.*—By *Bean, Burnett, & Eldridge:* 20 and 21, Dayton Grove, Peckham, u.t. 83 yrs., g.r. 11*l.*, r. 72*l.* 16s., 425*l.*—By *Robert Reid:* F.g.r. of 24*l.*, Oakley-st., Lambeth, reversion in 17 yrs., 790*l.*; f.g.r. of 19*l.* 2s. Coral-st., reversion in 17 yrs., 605*l.*; f.g.r. of 12*l.*, Oakley-st., reversion in 4 yrs., 460*l.*; f.g.r. of 78*l.* 16s. 6d., Coral-st. and Oakley-st., reversion in 15 yrs., 2,860*l.*; f.g.r. of 8*l.*, Thomas-pl., reversion in 15 yrs., 400*l.*; f.g.r. of 39*l.*, Coral-st. and Thomas-pl., reversion in 15 yrs., 1,725*l.*; f.g.r. of 40*l.* 10s., Waterloo-rd. and Coral-st., reversion in 15 yrs., 1,200*l.*; f.g.r. of 65*l.*, Webber-st., Waterloo-rd., and Cottage-pl., reversion in 17 yrs., 1,540*l.*; f.g.r. of 48*l.* 11s., Waterloo-rd., reversion in 18 yrs., 1,355*l.*; f.g.r. of 27*l.*, Webber-st., reversion in 17 yrs., 850*l.*; 19, 21, and 23, Coral-st., f., r. 31*l.* 10s., 620*l.*—By *Field & Sons:* 96, 98, and 100, St. John-st., Clerkenwell, f., r. 234*l.* 16s., 3,975*l.*; f.g.r. of 78*l.*, Grove Lane, Camberwell, reversion in 21 yrs., 2,370*l.*; 115 and 117, Grove-lane, f., 975*l.*; 121, Grove-lane, f., r. 42*l.*, 950*l.*; f.g.r. of 61*l.* 10s., Camberwell-grove, reversion in 21 yrs., 1,595*l.*; 140, Camberwell-grove, f., r. 33*l.*, 375*l.*—*By Baker & Sons:* 96, High-st., Portsmouth, f., 170*l.*; 9, 17, and 21, Arthur-st., f., 310*l.*; 1 and 3, Northwood-rd., Highgate, u.t. 38 yrs., g.r. 17*l.* 17s., r. 85*l.*, 595*l.*; 56 and 62, Leander-rd., Brixton, u.t. 95 yrs., g.r. 14*l.*, r. 72*l.*, 650*l.*; f. land, 58a. or. 20p., Carshalton, in 6 lots, 5,220*l.*

[*Contractions used in these Lists.*—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e.r. for estimated rental; u.t. for unexpired term; p.a, for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; yd. for yard, &c.]

PRICES CURRENT OF MATERIALS.

TIMBER.		
Greenheart, B.G.	ton	8/0/0 o/0/0
Teak, E.I.	load	10/0/0 16/0/0
Sequoia, U.S.ft.cu		1/10 2/2
Ash, Canada load		3 5 0 4/10/0
Birch, do.		2/15 0 4 0 0
Elm, do.		1/0/0 5 5/0
Fir, Dantsic, &c.		1/10/0 3 5 0
Oak, do.		2/15/0 4/15/0
Canada		5/10/0 7/0/0
Pine, Canada red		2/10/0 3/0/0
Do. Yellow		3/5/0 5/10/0
Lath, Dantsic, fath		4/10/0 5/10/0
St. Petersburg		5/0/0 6/10/0
Wainscot, Riga, &c., log		2/15/0 5/0/0
Odessa, crown		2/15/0 5 0/0
Deals, Finland and & 1st std 100		7/0/0 9/0/0
Do. 4th & 3rd		7/0/0 8/0/0
Do. Riga		7/0/0 8/10/0
St. Petersburg, 1st yellow		9 10/0 12/0/0
Do. 2nd yellow		7/10/0 9/0 0
Do. white		8/0/0 10/10/0
Swedish		7/0/0 15 10/0
White Sea		6/10/0 14/0/0
Canada, Pine 1st		22/0/0 26 10/0
Do. do. 2nd		17/0/0 18/0/0
Do. do. 3rd, &c.		7/10/0 10/10/0
Do. Spruce, 1st		8/10/0 10/0/0
Do. do. 3rd & 2nd		6/10/0 7/10/0
New Brunswick		6/0/0 7/0/0
Battens, all kinds		5'0 0 2/0/0
Flooring boards, sq., 1 in. prep. 1st		0/3/6 0/14/6
Do. 2nd		0/3/0 0/11/6
Other qualities		0/5/0 0 7/0
Cedar, Cuba	ft.	/3 /4
Honduras, &c.		/3 /4½
Mahogany, Cuba		/3 /6
St. Domingo, cargo	av.	/3 1/6
Mexican do. do.		/3 /4
Tobasco do. do.		/3½ /6
Honduras do.		/3½ /5½
Box, Turkey	ton	4/0/0 13/0/0
Rosa, Rio		7/0/0 18/0/0
Bahia		6/0/0 17/0/0
Satin, St. Domingo		0/0/5 0/2/0

TIMBER (*continued*).		
Satin, Porto Rico		0/0/6 0/1/6
Walnut, Italian		0/0/3½ 0/0/7
METALS.		
Iron—Pig, in Scotland	ton	2/2/6 0/c/o
Bar, Welsh, in London		5/12/6 5/15/0
Do. do. at works in Wales		5/2/6 5/5/0
Do. Staffordshire, in London		6/0/0 6/10/0
COPPER—British cake and ingot		42/0/0 42/5/0
Best selected		42'10/0 42/15/0
Sheets, strong		51/0/0 0/0/0
Chili, bars		39/17/6 40/2/6
YELLOWMETALlb		0/0/4¾ 0/0/4¾
LEAD—Pig, Spanish	ton	9/12/6 0 0 0
English com. brands		9/13 9 9/15/0
Sheet, English, 6 lbs. per sq. ft. and upwards		10/15/0 11/0/0
Pipe		11/15/0 0/0/0
ZINC—English sheet	ton	18/10/0 19/0/0
Vieille Montagne		19/10/0 0/0/0
TIN—Straits		62/2/6 62/12/6
Australian		62/5/0 62/15/0
English Ingots		67/0/0 67/10/0
Banca		65/10/0 66/0/0
Billiton		65'0/0 65/10/0
OILS.		
Linseed	ton	19/17/6 20/7/6
Cocoanut, Cochin		27/10/0 0 0/0
Do. Ceylon		24/10/0 0/0/0
Palm, Lagos		25/0/0 0/0/0
Rapeseed, English pale		21/0/0 0'0/0
Do. brown		19/10/0 0/0/0
Cottonseed ref.		17/15/0 19/0/0
Oleine		21/10/0 24/0/0
Lubricating, U.S.		4/0/0 5/0/0
Do. refined		5/0/0 12/0/0
TAR—Stockholm	barrel	1 1/0 0'0/0
Archangel		0'13/0 0 0 0

TENDERS.

[Communications for insertion under this heading should be addressed to "The Editor," and must reach us *not later than 10 a.m. on Thursday.*]

BRISTOL.—For making up Golden Hill, for the Horfield Local Board. Mr. A. P. I. Cotterell, C.E., Baldwin-street, Bristol:—

A. Collison	£580	J. Dare & Co., Redland*	£520
S. Ambrose	560	W. G. & A. Thatcher	498

* Accepted.

CHURCH (Lancs.).—Accepted at schedule of prices for the execution of street-works-sewering, Bank Canal-street, for the Local Board. Mr. Walter Stirrup, Surveyor, Church. Quantities by schedule of prices:—
Geo. Adams, Oswaldtwistle.

COLCHESTER.—For making roads, paths, drains, &c., in the new ground of the Colchester Cemetery, for the Colchester Joint Burial Board. Mr. Chas. E. Butcher, surveyor, 3, Queen-street, Colchester:—

	A	B
W. Chambers	£1,098 0 0	£889 0 0
G. Dobson	1,075 0 0	848 0 0
H. Crane	923 11 9	693 18 9
F. Dupont	825 0 0	530 0 0
A. Diss	730 0 0	525 0 0
Howard & Son, Colchester	710 0 0*	505 0 0

[A.—For roads of brick, rubbish, stone, and gravel, 7 in. thick. B.—For roads of stone and gravel, 4 in. thick.]
* Accepted.

CROYDON.—For building new room, for cookery and laundry, to the girls' department, and bath-room to the master's house, at the Board Schools, South Norwood, for the Croydon School Board. Mr. Robert Ridge, architect. Quantities by the architect:—

W. Holt & Son	£595	M. Taylor	£540
G. Bryan & Son	587	A. Jones	536
W. Akers & Co.	585	Bullock	525
Umlandt & Nicoll	573	Smith & Son	505
J. Bowyer & Co.	555	Bulled & Co.*	496
T. C. Hobbs	541		

* Accepted, subject to the approval of the Education Department.

GRIMSBY.—For the construction of subways for vehicular traffic, near the Peppercorn crossing, for the Urban Sanitary Authority. Mr. Marshall Petree, C.E., Borough Engineer, Town Hall, Grimsby:—

A. F. James	£5,060	3	
Hewins & Goodhand, Grimsby (accepted)	4,981	8	
J. H. Vickers	4,839	7	

KEIGHLEY.—For the construction of an outfall sewer, from Aire to Pitt-street, for the Corporation. Mr. W. H. Hopkinson, Borough Engineer, Keighley. Quantities by Engineer:—

A. Braithwaite, Newlay, near Leeds	£1,686	1	7

LEEDS.—Accepted for the erection of Wesleyan school buildings, Richmond Hill. Mr. Geo. F. Danby, architect, 46, Great George-street. Leeds:—

Brick and Stone.—Charles Myers	£1,140	0
Joinery.—T. Harrod	795	0
Plumbing and Glazing.—T. Barraud	215	0
Plastering.—W. Pennington	92	0
Slating.—Pickles Bros.	107	10
Painting.—A. Welham	45	0
Warming.—Holmes & Co.	184	0
Iron Railing, &c.—Dowgill & Co.	67	10
Total	£2,646	0

[All of Leeds.]

LEEDS.—Accepted for the erection of a Wesleyan manse, Richmond-hill. Mr. Geo. F. Danby, architect, 46, Great George-street, Leeds:—

Building.—W. Schofield	£370	10
Joinery.—T. Harrod	261	0
Plumbing and Glazing.—Carter & Crosland	62	0
Painting.—A. Welham	22	0
Slating.—J. Atkinson & Sons	41	10
Plastering.—J. W. Watson	62	10
Total	£817	0

[All of Leeds.]

LONDON.—For the erection and completion of block of buildings at No. 9, High-street, Aldgate, E. Mr. C. J. C. Pawley, architect:—

W. Brass	£12,250	G. Todd	£11,777
Battley & Co.	12,149	Higgs & Co.	11,038
Lascelles	11,850	Nightingale	11,490
Walker	11,853	Spencer & Co.*	11,470
Patman & Fotheringham	11,778	Turtle & Appleton	11,400

* Accepted.

LONDON.—For enlarging the Napier-street School, Hoxton, by 397 places, and for other works, for the School Board for London. Mr. T. J. Bailey, Architect:—

		For brick-work in cement, add
J. Willmott & Sons	£5,473 0	£93
N. Lidstone	5,237 0	90
Johnson & Co.	5,139 11	129
J. Grover & Sons	4,878 0	97
W. M. Dabbs	4,754 0	108
W. Holt & Sons, 23, Arundel-road*	4,561 0	59

* Recommended for acceptance by the Works Committee.

LONDON.—For sanitary works to Nos. 1, 2, and 3, The Sanctuary, Westminster, for the Directors of the Clergy Mutual Assurance Society. Mr. Walter J. Ebbetts, architect and surveyor, Savoy House, 115, Strand, W.C.:—

Dent & Hellyer	£315	0	G. H. & A. Bywaters & Son (accepted) £268 10
Geo. Jennings	292	0	

LONDON.—For rebuilding the "Barley Mow" public-house, Royal Hill, Greenwich, S.E., for Messrs. Whitbread & Co. Mr. A. L. Guy, architect, Bedford-row House, Bedford-row, W.C.:—

Godfrey	£2,148	Rosenberg	£1,955
Voller	2,070	Courtney & Fairbairn	1,893
Holloway	2,017	Simmonds	1,850
Jerrard	1,989		

LONDON.—For general repairs and alterations at Blomfield-place, Paddington, for Dr. Evans. Mr. Wallis Chapman, architect:—

	General Works.	Paving.	Fixing Stable Fittings.
Green & Son	£162 10	£14 10	£3 17 6
A. V. Paddison	160 15	16 12	14 3 8
Dixon & Co., Ltd.	143 0	9 0	3 10 0
Hayman Bros.	127 0	£9 10	

LONDON.—For the erection of a steam-bakery at 64, Northcote-road, Clapham Junction, including engineer's work, for Mrs. F. Keber. Mr. M. Vyne Treleaven, architect and surveyor, Acre-lane, Brixton, S.W.:—

Whitehead & Co.	£709	0	Phelps £658 0
Peacock Bros	696	0	Read & Son 613 0
Crabbe & Son	670	0	Hammond 610 15

LONDON.—For providing and fixing low-pressure hot-water apparatus at the Hackford-road School, Brixton, for the School Board for London:—

W. Jenkins & Sons	£533	0	J. C. & J. S. Ellis, Ltd. £457 10
J. Fraser & Son	544	0	Macguire & Sons, Dublin* 410 0
J. F. Clarke & Sons	499	0	
Wenham & Waters	465	0	

* Accepted by the Works Committee.

LONDON.—For the provision of cookery, laundry, and manual training centres, and also a centre for deaf children, in connexion with the Matthias-road School, Stoke Newington, for the School Board for London. Mr. T. J. Bailey, Architect:—

		For brick-work in cement, add
J. Willmott & Sons	£4,766	£72
J. Grover & Sons	4,631	60
W. Gregar & Son	4,437	65
N. Lidstone	4,398	69
McCormick & Sons	4,252	66
W. M. Dabbs	4,228	89
Killby & Gayford	4,190	66
Treasure & Son	4,122	94
E. Lawrance & Sons, Wharf-road, City-road*	4,104	75

* Recommended for acceptance by the Works Committee.

LONDON.—For providing and fixing low-pressure hot-water apparatus in the corridors and class-rooms of the boys' and girls' departments at the Alexis-street School, Bermondsey, for the School Board for London:—

J. Fraser & Son	£159	5	G. Davis £118 0
W. G. Cannon	154	0	J. H. Clarke & Sons 113 10
J. & F. May	137	0	Wontner, Smith, Gray & Co.* 112 16
J. Gray	132	0	

* Accepted by the Works Committee.

LONDON.—For the provision of manual training and laundry centres in connexion with the Peckham Park School, Peckham, for the School Board for London. Mr. T. J. Bailey, Architect:—

		For brick-work in cement, add
A. Black & Son	£2,487 0 0	£44 0 0
H. Leney	2,312 2 9	26 11 6
Mid-Kent Building and Contracting Works, Limited	2,234 0 0	44 0 0
J. Marsland	2,209 0 0	45 0 0
J. Smith & Sons	2,173 0 0	45 0 0
Holliday & Greenwood	2,162 0 0	42 0 0
(No name)	2,153 0 0	22 0 0
J. & C. Bowyer, Upper Norwood*	2,110 0 0	44 0 0

* Recommended for acceptance by the Works Committee.

LONDON.—For the provision of a manual training centre in connexion with the Risinghill-street School, Pentonville, for the School Board for London. Mr. T. J. Bailey, Architect:—

		For brick-work in cement, add
G. Lyford	£1,440 13	£26 0
Mid Kent Building and Contracting Works (Limited)	1,309 0	33 0
George Newton	1,293 0	26 0
McCormick & Sons	1,246 0	26 0
E. Houghton & Son	1,231 0	33 0
Vernall Danes & Co., 12, Albany-street, N.W.	1,207 0*	32 12*

* Recommended for acceptance by the Works Committee.

LONDON.—For carrying out repairs to the schools of the School Board in the following groups of the under-mentioned divisions on the printed schedule of prices for repairs. The following shows the percentage required by each contractor to be added to the printed schedule of prices:—

Hackney, Groups 3, 4, and 5.

	Group 3.	Group 4.	Group 5.
McCormick & Sons	25 per cent.	25 per cent.	25 per cent.
T. Cruwys	20 ,,	20 ,,	20 ,,
Stevens Bros.	23 ,,	20 ,,	20 ,,
Gibbs & Co.	17½ ,,	17½ ,,	17½ ,,
T. White & Son*	13 ,,	13 ,,	13 ,,

Greenwich, Groups 4 and 6.

	Group 4.	Group 6.
Mid-Kent Building and Contracting Works, Ltd.	16 per cent.	16 per cent.
H. Leney	15 ,,	15 ,,
J. & A. Oldman	20 ,,	19* ,,
A. Black & Sons	15* ,,	15 ,,

* Recommended for acceptance by the Works Committee.

LUTON.—For new boiler-house, and additions to manufacturing premises, Gordon-street, for Mr. J. Hill. Mr. A. Wilkinson, architect:—

J. Saunders	£255 13	T. & E. Neville (accepted)	£245 0
W. G. Dunham	254 10		

[All of Luton].

MANCHESTER.—For the execution of street works, Crossford- and Lacy-streets, Stretford. Mr. John Bowden, C.E., 14, Ridgefield, Manchester:—

Worthington & Pownall	£890 0 0	F. Eyre	£743 13 6
Wm. Burns	852 14 0	Thos. P. Willan	721 11 7
M. Naylor & Sons	781 7 0	George Boyson, Ashton-on-Mersey*	640 0 0
A. & H. Hulse	748 9 0		

* Accepted.

MOUNTAIN ASH (Glam.).—For the construction of 400 yds. 9-in sewer, for the Local Board. Mr. John Williams, Surveyor, Town Hall, Mountain Ash:—

Gardner & Happerfield	£229 19 0	Batchelor & Snowden.	
Thomas Taylor	205 0 11	Cardiff (accepted)	£199 18 0

PWLLHELI (N. Wales).—For the erection of vagrant-wards and labour-yard; also additions to Board-room, at the Workhouse, for the Union Guardians. Messrs. Thos. Roberts & Son, civil engineers, Portmadoc:—

W. G. Evans	£889 0	W. Owen	£644 0
Evans Jones	850 0	J. Roberts	630 0
Robert Roberts	696 10	J. Jones	621 0
J. Hunter	673 10	J. Watkins, Pwllheli*	575 0

[Architect's estimate, £621].
* Accepted.

RUABON (N. Wales).—For the erection of a house for the police at Upper Ponkey, for the Standing Joint Committee:—

Jas. Whittingham	£356
Jenkins & Jones, Johnstown, Ruabon (accepted)	332

RYHOPE (Durham).—For the erection of premises for Mr. Walter Willson. Mr. Stephen Piper, architect, County Chambers, Newcastle-on-Tyne:—

Thos. P. Shaftoe	£1,834	John B. Stott, Sunderland*	£1,688
T. Lumsden	1,806	G. Moir	1,660

* Accepted.

SCARBOROUGH.—Accepted for the erection of a pavilion, for the Cricket Club. Messrs. Hall & Tugwell, architects, Scarborough. Quantities by architects:—

John Jaram, Gladstone-street, Scarborough £1,473

[Twenty-one tenders submitted.]

STROUD.—For the erection of a laundry drying-house, at the workhouse, for the Union Guardians:—

T. L. Chew & Sons, Stroud (accepted)	£154 16
Henry Beavis (too late)	130 10

TAUNTON.—For the execution of sewerage works, Staplegrove, for the Rural Sanitary Authority. Mr. T. G. Crump, architect:—

Vickery & Poole, Milverton	£445

WINCANTON (Somerset).—For the erection of school buildings, for the School Board. Mr. Hudson, architect, Wincanton:—

A. Poole	£4,350	T. Green, Wincanton*	£3,450
Robt. Elcock	3,995	W. Newman	3,400
Jenkins & Sons	3,825		

* Accepted.

TO CORRESPONDENTS.

J. T. M. (shall have attention).—W. H. T.

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WINDOW, OLDBURY CHURCH, SALOP.—By Mr. Alfred O. Hemming.

Royal Academy Exhibition, 1894.

S. Nicholas. Blundellsands

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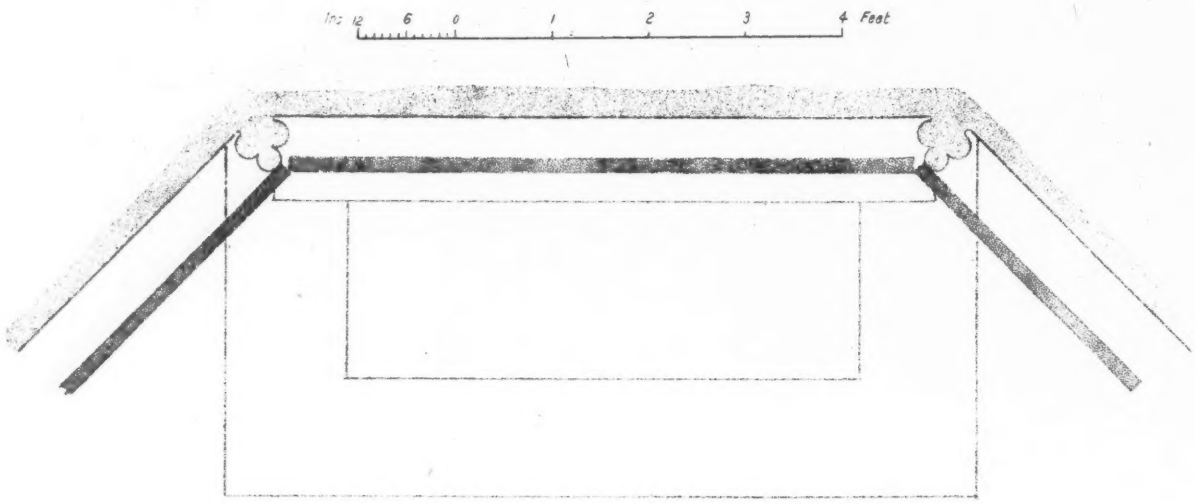

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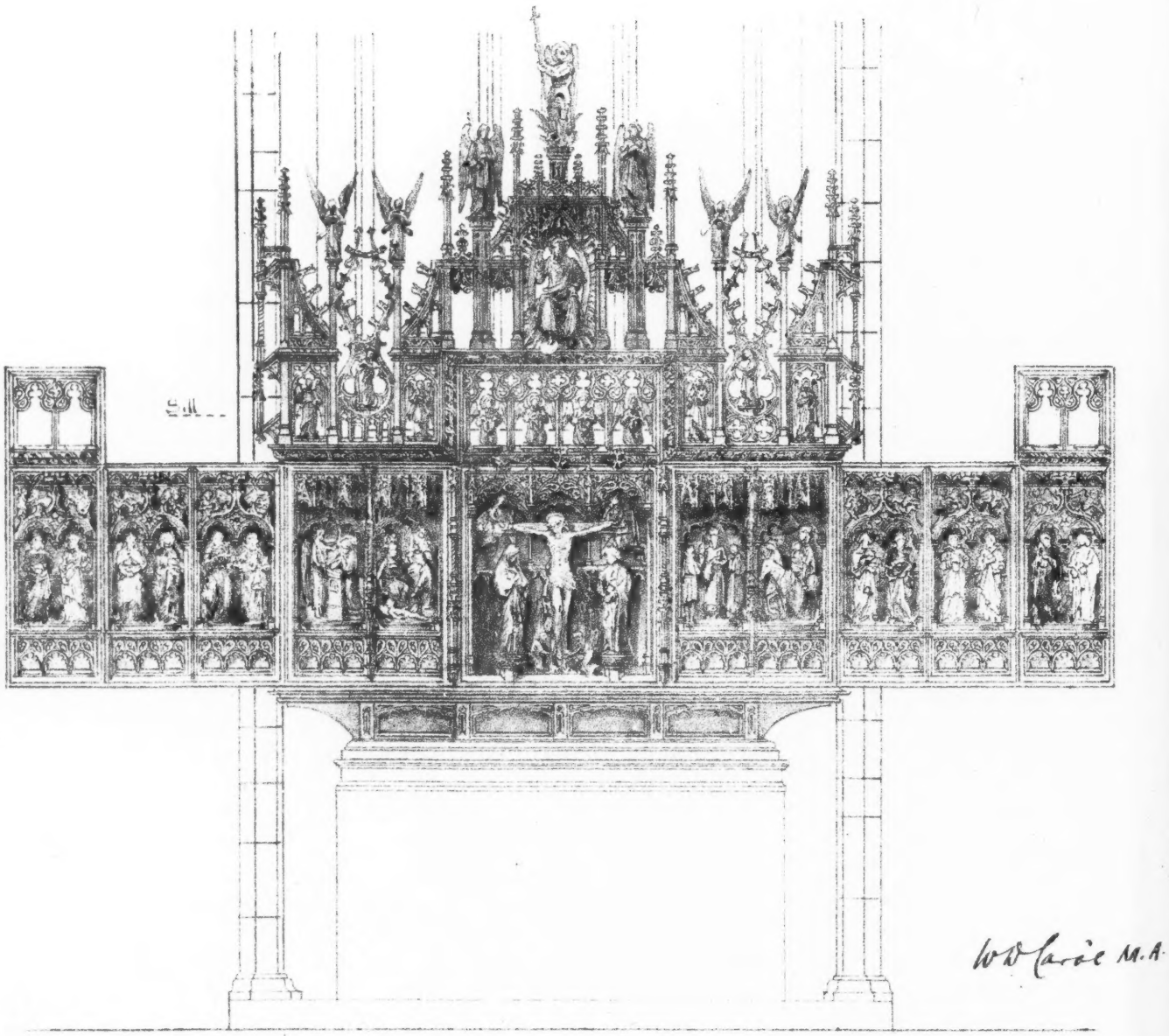

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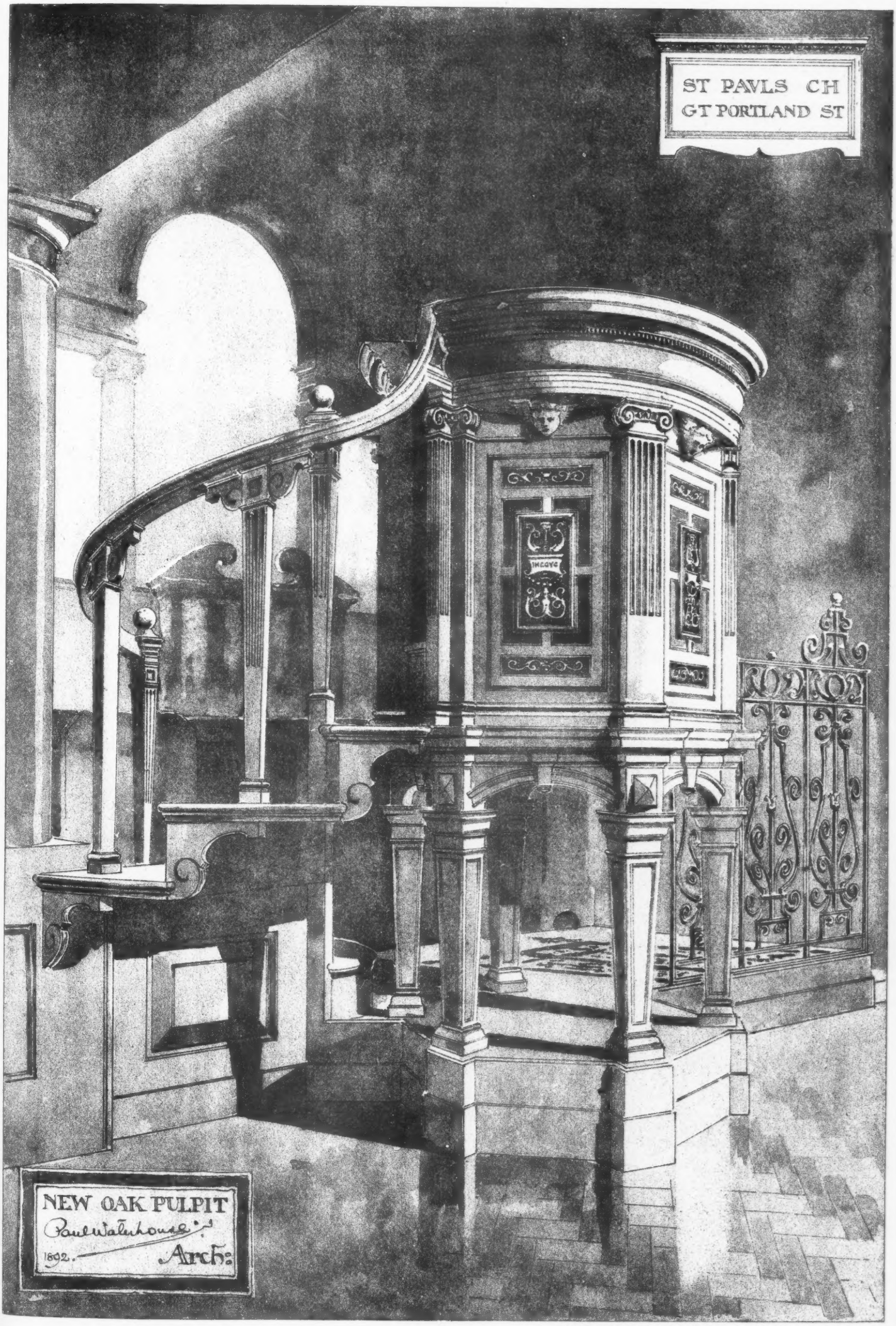

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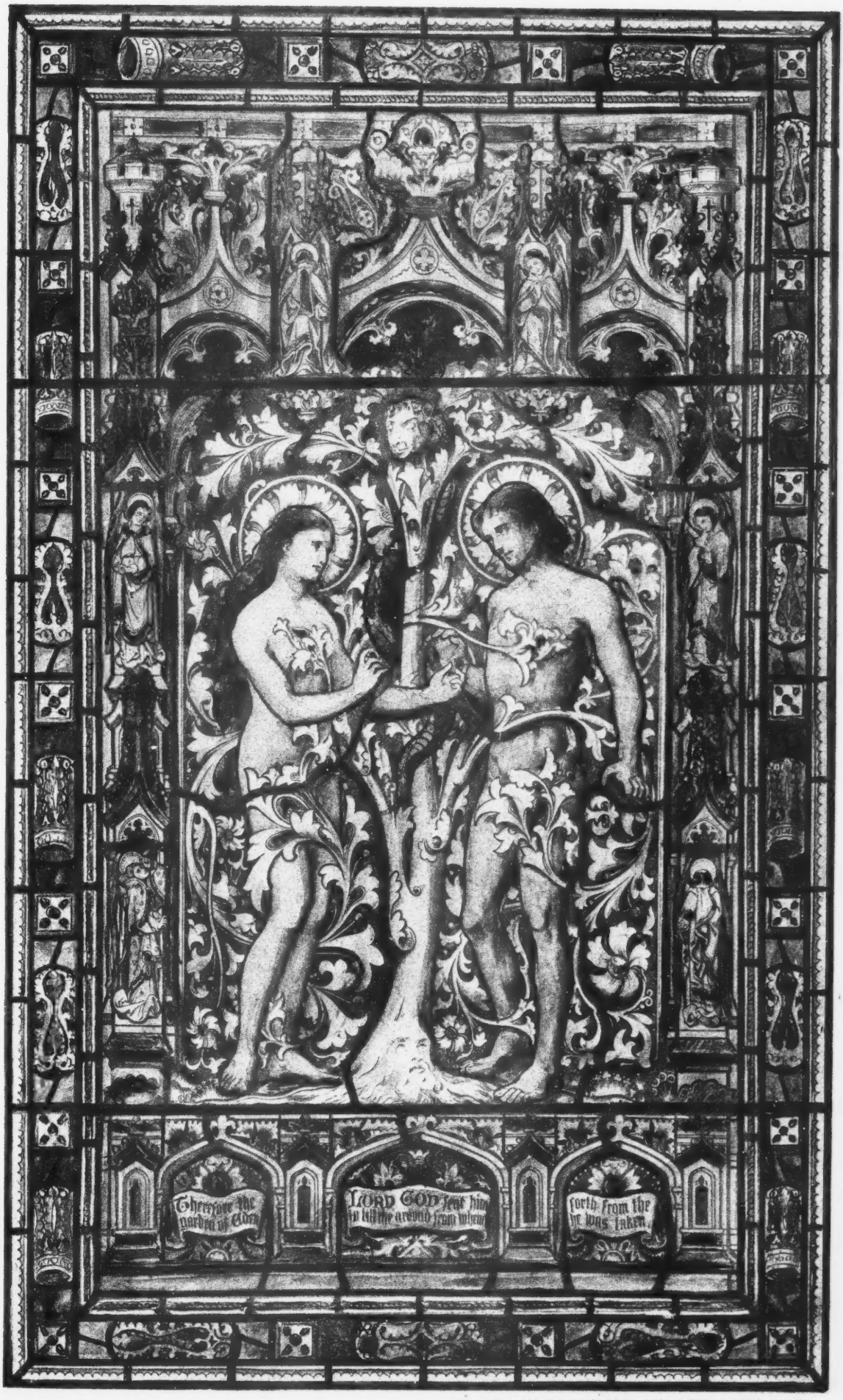

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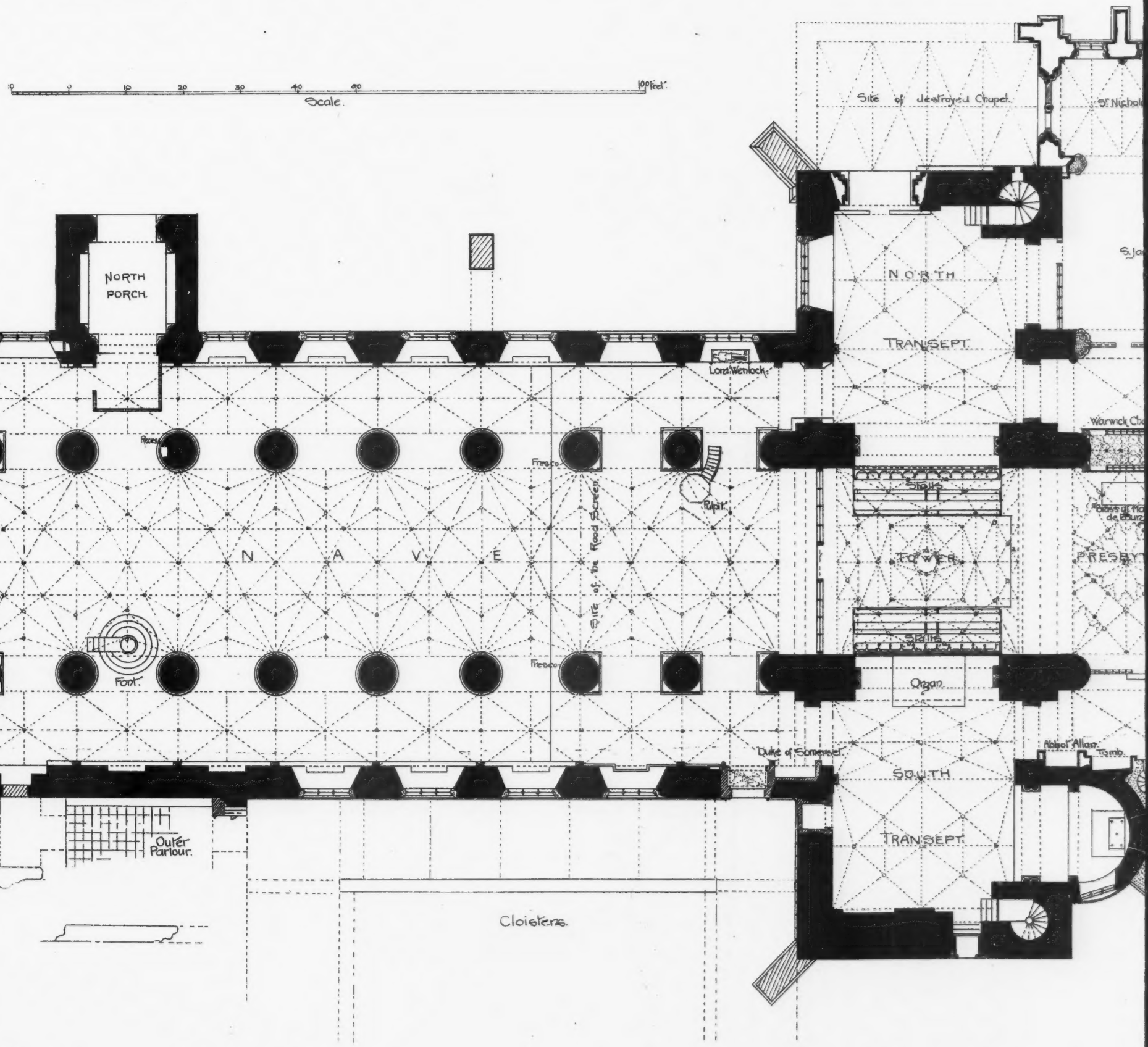
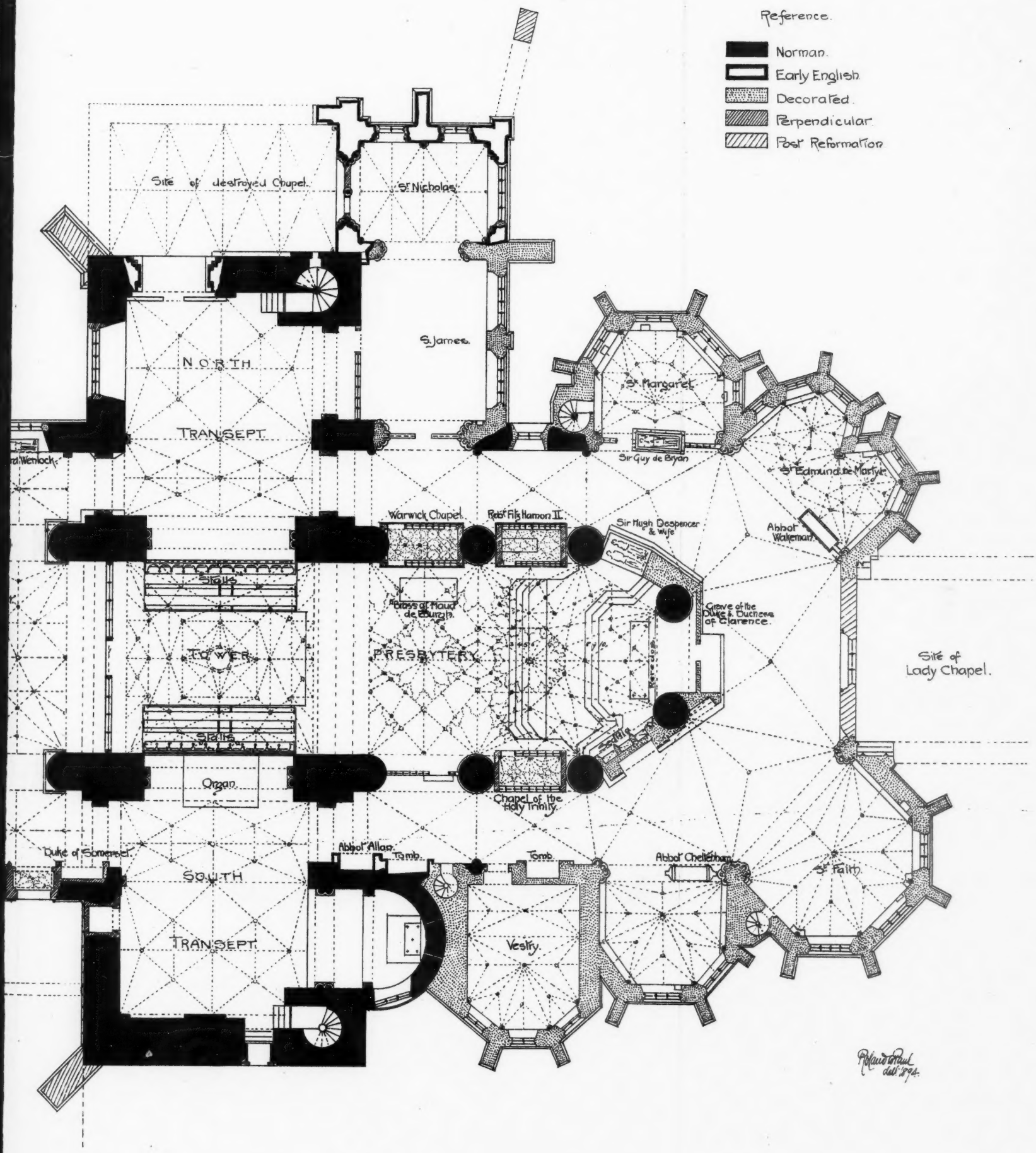
DESIGN FOR STAINED GLASS.—By Mr. P. H. Newman.

Royal Academy Exhibition, 1894.

TEWKESBURY ABBEY CHURCH.

Ground-Plan.





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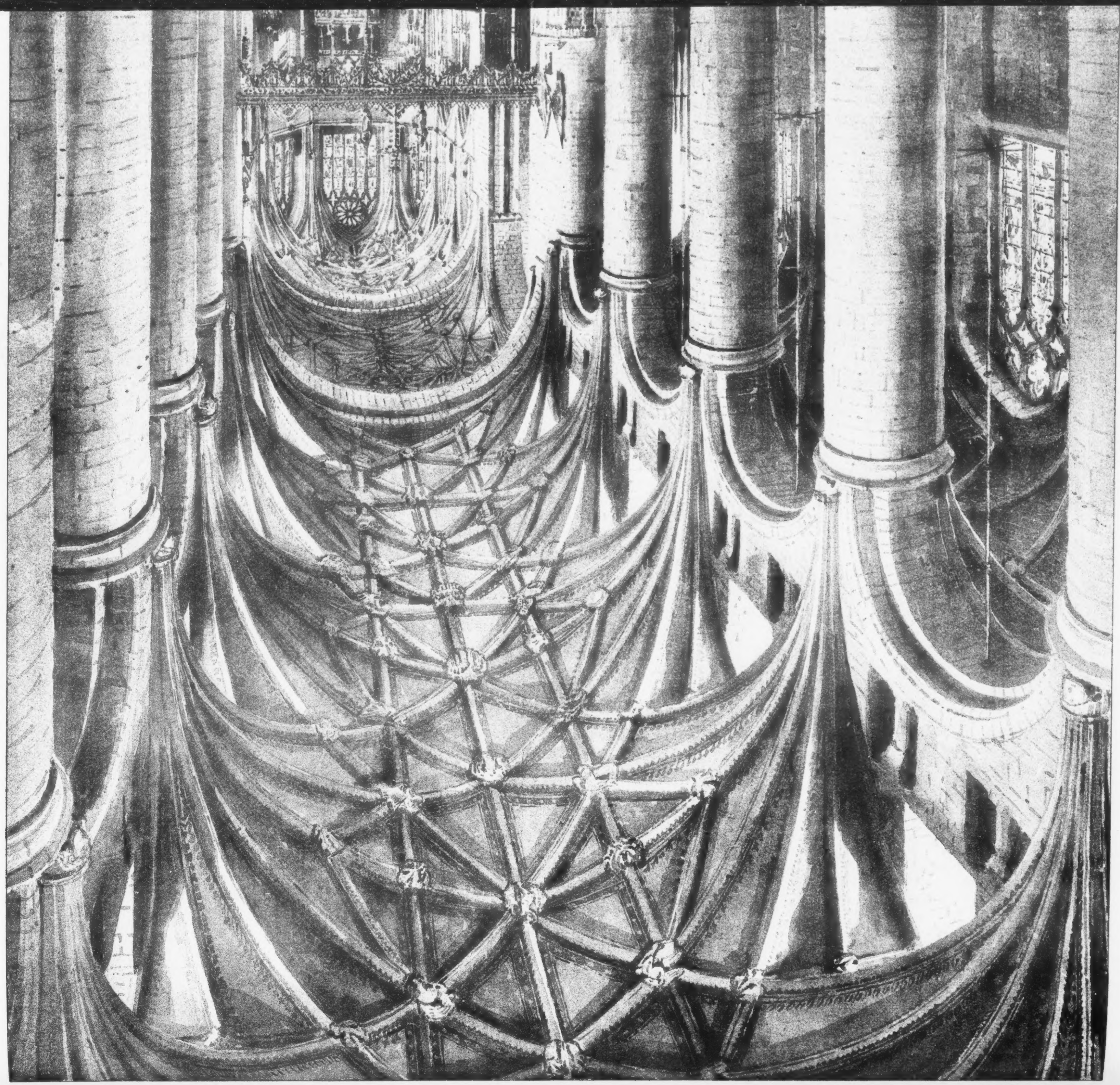

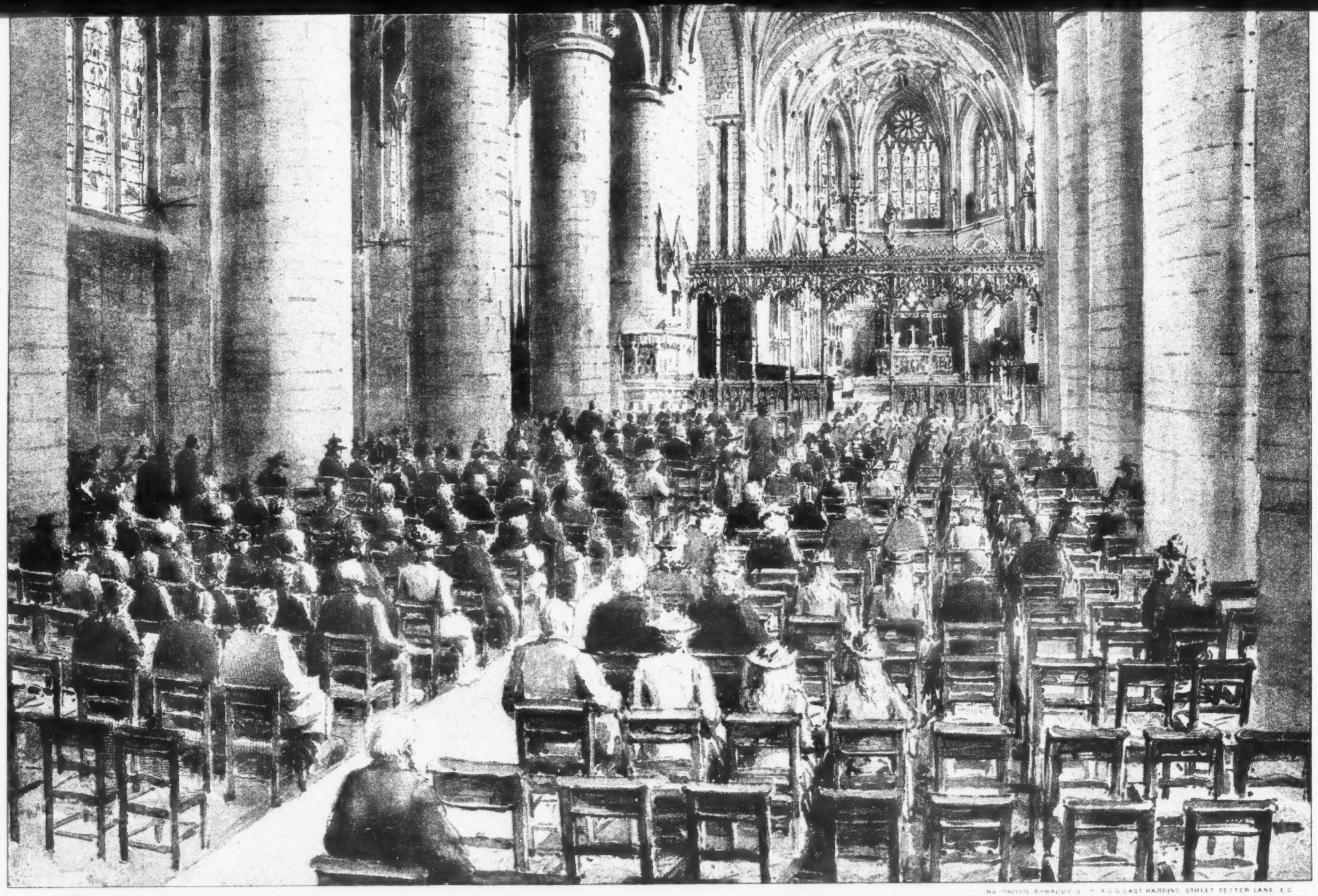

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Drawn by Mr J H Slater